

# Aviation Week

*and Space Technology*

75 Cents

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October 2, 1961

SPECIAL REPORT:

**Roving Lunar  
Vehicles**

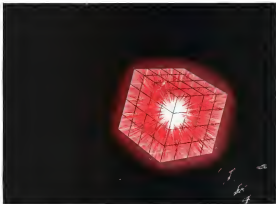
First Saturn Flight Booster



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## space systems planning and engineering in a unique role

The scientists and engineers of Aerospace Corporation are in the forefront of advanced planning and general systems engineering. Their unique role: critical civilian task setting, government and the scientific-industrial team developing space systems and advanced ballistic missiles. In this mission Aerospace Corporation provides advanced systems analysis and planning, theoretical and experimental research, initial systems engineering, initial technical direction and general technical supervision. Specific activities include investigation of techniques for improving the state-of-the-art in propulsion, structures, guidance, communications and other engineering skills related to missile/space systems, feasibility studies of new weapons systems concepts and preliminary design of guidance systems. Formulation of development programs, conduct of critical experiments, technical supervision of the development and test program. Immediate assignments exist for those highly skilled in these specialties and who are knowledgeable in inter-disciplinary problem solving. Men with advanced degrees are urged to contact: Mr. Herndon, Aerospace Corporation, Room 101, P.O. Box 95011, Los Angeles 45, Calif.

*Open to the public interest and dedicated to providing effective leadership in the advancement and application of space science and technology for the United States Government*



AEROSPACE CORPORATION







Ion thrusters show G-E plasma accelerator on test. Engine thrust from the generator (left) at right, which acts as the motor (right), is maintained by passing through a field maintained by the large magnets on either side.



An jet engine such as the one shown in operation here has been successfully run in G-E laboratories for several years. Present state-of-the-art at General Electric indicates that an jet jet can be ready for flight test by late 1973.

## G.E. Tests Electric Engine Types for Space Missions

A line of electrical space engines whose diverse capabilities can provide vehicle speed, attitude, and deviation for a wide variety of space missions is under test at General Electric.

Three basic engine types—arc jet, plasma converter, and ion engine—constitute the line. Models of each type are currently in operation at the Company's Flight Propulsion Laboratory Department in Cincinnati.

Under NASA contract, G-E has tested a 300kW arc jet engine, a 300kW ion jet engine that develops one-half pound of thrust. Performance indicated on test indicates it is useful for space missions such as lunar transfers, transfer to stationary satellite orbits, and placing communications satellites in precise orbital position.

Plasma converter, second in G-E's line of electrical space engines in terms of specific impulse, are in early research stages at the Cincinnati plant. A continuous flow device, which has already been tested, shows promise of good performance in the

higher power ranges at specific impulse rates which look attractive for lunar missions.

Ion engines, whose specific impulse can theoretically rise to several hundred thousand seconds, are expected by G-E to prove vital for long distance space travel such as interplanetary missions. Since 1958, when General Electric engineers ran one of industry's first ion engines, continuing research and development has produced

a variety of improved configurations.

A number of component development programs are also underway to G-E's ion engine program. Among these are studies investigating methods for generating and accelerating ions, increasing electrical conductivities in electron vapor, developing a system for feeding ionization propellants to ion engines, and accelerating electrical space thrusters.

## NEW STUDIES TO EXPLORE SYSTEM COMPATIBILITY

Studies are under way at the G-E Flight Propulsion Laboratory Department to pinpoint future problems of matching electrical propulsion systems to space power generation plants. G-E's intention is to produce the needed answers before power or propulsion systems development gets into expensive hardware stages.

A basic element of the studies will be to identify "voltage" compatibility problems of relevant space systems. For example, it appears that arc jet engines, in full-scale long-life requirements, may require voltage input somewhat higher than considered optimum for generator design. Where, then, should a total system compromise be established?

### VARIABLES TO BE INTEGRATED

G-E's answers to this and other typical questions will incorporate a vast number of "internal" variables in engine and turbogenerator design, including such necessary data as the effect of turbine and boiler flow control, and heater control methods.

Studies will be heavily influenced by consideration of mission duty cycles anticipated for future space power/propulsion systems. As a typical ex-

ample, extended periods of engine-off conditions during space travel require a study of power dumping methods. Should the power system's total output be modulated by reactor and turbine control? Or should the power be fed into dummy loads, maintaining the powerplant at full rated condition?

### IMPORTANT INSIGHTS FORBIDDEN

Answers to such questions, believes General Electric, will provide badly needed insight into nature of optimum space-to-earth power/propulsion systems for each envisioned mission. Broad knowledge to be gained by the G-E study center around two fundamental questions:

—What can be realistically done with present technology?

—What areas will require additional applied research to make needed systems practical?

With accelerated space schedules tending to compress development cycles, G-E management believes that the answers obtained—and questions rekindled—by these studies will permit considerable savings in the nation's future space power/propulsion systems development costs.

## New Computer Program Speeds Ion Engine Design Solutions

Ion engine configurations can now be quickly and accurately evaluated by a new digital computer program developed at G-E's Flight Propulsion Laboratory Department.

In a typical project, the computer system routinely evolved a new ion engine configuration that is expected to have doubled the efficiency of its forerunner. Design of the new engine, designated the XE-703-4, was quickly followed by the computer in the direct absorption of the ion beam with the electrodes a virtually eliminated. (Such beam interception reduces engine life and efficiency, both extremely important for space missions.)

### COMBINED BY NASA

The fully automated computer program was created under contract with NASA's Marshall Space Flight Center. G-E's program was four computerized links and three display links for monitoring engine progress. A computer mesh plotted over a cross-sectional engineering drawing of the engine defines all evaluation points to the ion beam and the engine's output.

Once this programming has been set up, each of the 180 to 200 points by the computer through a 4000-point mesh requires less than two seconds.

Comparable times are required to compute such factors as ion scattering forces and space charge densities. The program is intended for use in previous runs are repeated until desired accuracy is achieved.

Speed of a typical analysis is such that a complete check-out of a new engine can be completed in less than an hour, including analysis of initial ion velocities and space charge.

## G-E ARC JET SUCCESSFULLY RUN ON A-C POWER

An important stride in ion jet technology was announced by General Electric recently after the Company successfully developed and run a 300kW engine that operates on alternating current.

The new engine has met thrust and specific impulse targets set by NASA, which granted the development program contract.

Initial tests with arc jet engines throughout industry have concentrated on d-c powered designs because of their relative simplicity. But space power generation systems currently under development tend toward high frequency, multi-phase alternating current because it permits larger weight savings.

### A-C APPROACH HELPS

Despite many problems inherent to a-c jet development, G-E elected to follow this approach. It recognized its important value in eliminating difficulties and other nagging components



Typical of nuclear space power systems now under study at General Electric is this 300 kilowatt package. Heat from the reactor (right) is converted to electrical energy by the turbine-generator. Motor heat is diverted into space by a radiator located beneath the reactor's shroud at the larger end of the radiator.

## New Facilities Boost Space Power Research

A 300kW, 500°F alkali metal test facility was placed in operation recently at General Electric's Space Power Laboratory in Cincinnati. Other in-house research projects will investigate heat transfer characteristics of boiling and condensing alkali metals, which are used in working fluids in nuclear turboengines for space.

Several larger, more versatile metal test facilities are in various stages of planning and construction at the Laboratory.

Within a few weeks, a 300kW facility designed to operate at 3450°F will be completed. Following is the next future will be a 100kW, 2200°F unit and a 3000kW, 1950°F unit.

### THIRD G-E GROWTH

These facilities provide a growing research complex at G-E's Flight Propulsion Laboratory Department here, where development of large electrical power generating systems for space has been under way since early in 1951.

General Electric is presently focusing

research on nuclear turboengine systems which combine a nuclear reactor heat source and turbine-driven electrical generators. Alkali metals such as potassium and sodium are used as working fluids. Such systems will provide power for electrical propulsion, electronic equipment, and life support.

Present research includes various analyses in basic technology, component development, and system analyses.

### HEAT TRANSFER STUDIES

In a program under NASA contract, the Laboratory is conducting boiling and condensing experiments on potassium and sodium to establish heat transfer characteristics and provide design data for space power systems heat transfer components in the 1300° to 2300°F temperature range.

Another NASA-supported program entails determining a potassium-vapor turbine applicable to large space power systems. In the 300kW facility now under construction, two turbine stages at an 1800°F, 500kW turbine will be operated on hot potassium vapor for more than 3000 hours.

These and several other research programs are being conducted by General Electric to have a space power system—having maximum risk and maximum reliability—ready when the call comes for an integration into future power/propulsion systems.

From future space propulsion systems, a key problem in development was the question of ignition. While arc jet systems take place only once, it was suspected that with flow-through, a-c arc might be extinguished and that there would be problems of re-ignition.

### COMPUTER PIONEER SOLUTION

However, a computer program, supported by later measurements, proved that while only two electrodes would be conducting at any one time and the third would be extinguished, on re-ignition would occur without re-ignition of the extinguished arc.

Under another program for NASA, General Electric is discussing the design of a space power system for a-c jet engine. Studies are continuing around larger turbines, turbines to stationary units, and installation of communication satellites in power orbits.

### SEND FOR FREE BROCHURE

For more information on General Electric's space power and propulsion programs, just send a letter to: General Electric Company, Bulletin 719-07, Schenectady 5, New York, and ask for a free copy of GE-443, "Electric Power/Propulsion for Space."

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

Typical of ion engines on test at General Electric is this enhanced design XE-703-4 model, whose efficiency was theoretically doubled with a new computer program.

# A New Achievement in Precision Controls for Space Application

## Marquardt Documents 1,000,000th Pulse of Radiation Cooled Bipropellant Rockets

A three year research and development program directed at advanced space propulsion and control systems reached a significant milestone on September 8 when The Marquardt Corporation documented the 1,000,000th pulse of radiation cooled bipropellant pulse rockets. These rockets, operating at pulse frequencies up to 100 cycles per second, demonstrated that required response and delay times of .006 second and effective pulse widths of .005 second are now attainable. Development to reduce these times is currently in progress. Typical of Marquardt's pulse rocket development in the range of 0.5 to 100 lb. thrust is a 25 lb. thrust rocket for a control satellite propulsion requirement. This engine demonstrated an instantaneous operational life of over 20 minutes at rated thrust and has achieved a reasonable 40 minute continuous run. At the end of the test, there was no evidence of system deterioration. This type of rocket engine has repeatedly demonstrated a power tip of 310 seconds using hydrazine and nitrogen tetroxide as propellants.

Coupled with Marquardt's secondary systems; gasbearing techniques, and throttleable nozzles, these pulse rockets make possible a range of control systems that can meet the most advanced space control requirements. In a complete dual independent motion, a Marquardt system can provide mass course velocity control, orbital position-control, descent-ascent control, and linear circumnavigation.

Marquardt's sixteen years of research and development in control have led the company into many pioneering areas in the aerospace field. In variable thrust engines, Marquardt rockets, using storable liquid propellants, pushed an average  $C^*$  efficiency of 95% over a wide throttling range. Successful investigations and developments have been achieved in improvements for thrust vector control, including tip-off of hot gases from the primary combustion chamber, cold gas-jets to extinguish or cool, non-eroding liquids such as freon and reacting liquids such as hydrazine.

The Marquardt Corporation today provides the aerospace industry with one of the most extensively documented records in the area of space propulsion control systems and components. Be it part or package, Marquardt can prove a record of performance which insures reliable products delivered on time and at minimum cost. For additional information contact R. L. Okamoto, Chief Application Engineer, Power Systems Division.

Engineers experienced in these or related fields will find it convenient to discuss current failures with Marquardt—an equal opportunity employer.

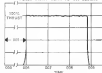
**THE Marquardt CORPORATION**

CORPORATE OFFICES: SAN RAY, CALIFORNIA

ARTIST: GORDON DAVENPORT

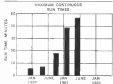
• POWER SYSTEMS DIVISION

TARGET LEVEL FROM ONE TO 200 POUNDS  
PULSE WIDTH DOWN TO .005 SECONDS



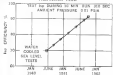
### DOCUMENTED IMPULSE CAPABILITY

The above test records document a pulse width down to .003 second.



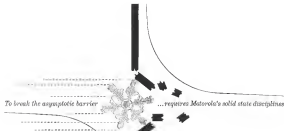
**RADIATION COOLED THRUST CHAMBER RUN**  
Continuous 48 hours run duration of radiation cooled thrust chamber with H<sub>2</sub> and N<sub>2</sub>O<sub>4</sub> demonstrated a 90% efficiency with no degradation in performance during run and showed no adverse effects on the system.

THRUST MEASUREMENT  
PROPELLANT FLOW



### DEMONSTRATED 90% EFFICIENCY

This chart shows thrust efficiency increase over slightly more than two years. Latest tests gave an tip of 310 seconds during a six minute run at 0.01 PSIA.



**INTRINSIC CHANGES** to molecular engineering techniques are required to break the asymptotic barrier of systems complexity versus systems reliability. The keys for Motorola's solid state electronics capability has been as carefully laid down as the vapor phase formation of an epitaxially grown, single-layer crystal. At Motorola, scientists and engineers have been brought together in our superbly equipped organization under single leadership. These molecular specialists have at their command the disciplines associated with semi-conductors, epitaxial growth, crystals, deposition, thin-films, surface passivation and encapsulation, electronic ceramics, and equipment and systems design. They are masters in the design of solid state equipment and systems of superior reliability and performance. Motorola-integrated circuit research and development, using thin-film and semiconductor hybrids and pure morphological circuit structures, have opened new areas of electronic technology to practical applications. If your application problems lie within the parameters of solid state electronics, look to Motorola for practical solutions.

**Military Electronics Division**



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All qualified applicants will receive consideration for employment without regard for race, creed, color, or national origin.

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times the yield strength of carbon steel. It delivers a high minimum yield strength of 168,000 psi. This permitted the missile motor case to be fabricated from plates only 0.313 inches thick. If steel with less strength had been used, weight of the motor case would have been greatly increased. Heavier casings would require more thrust and more fuel. Low cost fabrication, Inlercontinental Manufactur-



Submersa is used for the submersible water level gauge. It is a small and simple device, but it is very accurate and reliable. It is used for measuring the water level in the river and the sea.



Other radars by Sperry range from a portable field unit for detecting enemy vehicle and personnel movements in combat, to a network of giant area defense "fortress" radars on 24-hour air search duty continent-wide. Tracking, guidance, navigation, weather, tactical search, area defense—advanced Sperry radars are on duty in these and many other areas of commerce and defense—in-action evidence of one of the widest-ranging radar capabilities available today. General offices: Great Neck, N. Y.





# Four ways to tell a true airlifter



1. Loads from the rear



2. Truck-bed height



3. Paradrops big equipment



4. Lands on short, rough fields



**A true airlifter** is a special breed of bird—built without compromise for its special kind of work. Huge rear doors allow cargo to be loaded straight in. Cargo floor is truck-bed height; no hoisting cargo up and jockeying it around corners. Rear doors can be opened in flight for bulldozer-size paradrops. And a true airlifter need not be pampered with paving. It lands and takes off in sand and rough dirt, close to the action, just like a bush plane. Lockheed's C-130 Hercules project is the true airlifter. Now in its second million miles of operation, 14 different versions are flying or being built for the U.S. Air Force, Navy, Marines, and Coast Guard—and for the air forces of Canada, Australia, and Indonesia. Newest model, C-130E, will soon haul huge cargoes on MATS' worldwide routes. The big Lockheed/Georgia cargo jets of the future will be true airlifters, too; they will have the same four basic attributes Hercules has.



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## The Military Space Role—III

Since the series of editorials began early last month, the concern over defining and implementing the proper military role in the U.S. national space program has been growing. Last week, in Philadelphia (see page 28), a distinguished forum of leaders in the space field emphasized again the growing military threat from the Soviet space program, and the folly of our initial approach was in ignoring key points in our military applications of space technology, and excluding the military from pursuing a vigorous research and development program in this area adequate to meet the operational requirements that will inevitably be thrust upon it in the near future. We have also received a good deal of mail and comment indicating that many of our readers are equally concerned over this problem, although some of them apparently interpret our comments as a plea for complete military domination of the space effort.

Although in retrospect this might have been feasible during the immediate post-Sputnik period when the military already had a considerable capability to handle this assignment, it is certainly not feasible now with the existence of the National Aeronautics and Space Administration. Nor is it really necessary to solve the problem created by the designation of the military space role in the initial organization of NASA and the authorities to which this intent has been carried in its early operations, particularly the Mercury program.

## Management Unification

The requirements of NASA and a military space program have many similarities and many differences. What is really needed now is a managerial structure that effectively unifies all of the current and future capabilities of both civil and military space organizations to explore all of the areas that both require and to do all the applied research that both will need to develop operational systems.

Despite all of the various stabs at NASA Department of Defense losses during the past few years, no such effective management pattern has yet emerged and there are now signs that it is likely to form current discussions. There is no effective interface between NASA and the Air Force organizations where the bulk of the military space research and development capability is concentrated.

The Department of Defense, in all of its various upper strata, must share considerable blame for this situation. Because of its top heavy superstructure the Department of Defense handles all of its policy decision (in concert with NASA) at a level far removed from the organizations and people within the military services who are most

concerned with the military problems of space technology and who organize and operate the research, development and test facilities where the bulk of this work is being done. This will indeed be a difficult problem to solve because the Defense Department personnel now handling these vital matters are firmly convinced they are experts on the subject and that they are handling the problem well. This fact that the military space problem is a message seen only by bloated staff members and megalomaniacs.

At an even lower level the military appearance does another problem in the top echelons of the Air Force itself, where there is still an substantial group working vigorously to prepare for World War II. It is convincing proof of the dramatic technology of our times that even the ancient of the military services, in evidence for little more than a decade, should have the sense of the last conservatives holding fast to the technical conservatism in which they matured.

## Budget Conscious

This "lock the fire" school views the new technologies with alarm and wrapping because of the increasing expenditures of the service budget this are absorbing and because of the possibility that this would force required atmosphere-based vehicles into a secondary military role.

These military conservatives apparently want to wait until all of the basic research and development in space technology has been done by NASA and then decide at their leisure whether there are indeed any military applications of this technology. Unfortunately, the pace of these glibbing technologies will not permit this type of approach without incurring incalculable national disaster. It should be obvious to all by now that the Soviets have already grasped the political and military implications of the new technologies and are pressing at the fastest pace within their capabilities to take full advantage of them.

What is really required to resolve the space problems that are pressing upon us as urgently is a basic new look at the goals of our national program and how we can best achieve them with the resources already available and those that must be obtained in the foreseeable future. Out of this new look must come a more effective planning and working fusion between NASA and the real military space leaders. Since neither the Department of Defense nor NASA is likely to take the initiative in this area, it appears to be an opportunity for the National Aeronautics and Space Council, in its new and vigorous form, to step in as the catalyst that is so badly needed.

—Robert Holtz

THE U. S. NAVY'S

# Polaris Platoon System

When a Polaris sub makes port, there's a new crew ready to take her out again. For America cannot spare her crew one day.

This platoon system keeps each sub and her 16 Polaris missiles on station continuously.

The distant power of Polaris grows steadily stronger—as longer-range versions are perfected, and as more Polaris subs are commissioned.

Lockheed is Polaris missile prime contractor, system manager. Major subcontractors: Aerojet-General, General Electric, Westinghouse.

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## NOW PCM TELEMETRY SYSTEMS ... for millivolt data inputs!

Now on short delivery schedules....Texas Instruments offers high accuracy pulse code modulation telemetry systems for millivolt, high level or combination inputs.

The complete PCM system shown is a lightweight, 8 cubic foot package that multiplexes and encodes 196 analog channels to eight-bit accuracy and processes six digital data inputs. Output information rate is 173,000 bits per second. The system's unique zero and full scale digital servo loop corrects system drift and gain change to insure overall system accuracy of  $\pm 0.4\%$  in remote environments. Precision low-level electronic communica-

tion is accomplished with less than  $\pm 50$  microvolt offset error over a 0 to 70°C temperature range.

PCM encoding and decoding is only one of several advanced data link projects at TI. Others include millivolt oscillators, signal conditioners, solid-state transmitters, FM FM systems, advanced aerospace components, programmers, command and control systems, and space electronics. For detailed information on TI's capability to meet your particular requirements, contact MARKETING DEPARTMENT.

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## WHO'S WHERE

### In the Front Office

Robert C. Bakum, president, Ryan Astronautical Co., San Diego, Calif., succeeded J. Claude Ryan after six years as head of Ryan and chief executive officer.

J. Niven Foley, executive vice president, Chetco-Wright Corp., Woodbridge, N.J., joined Aermet Corp., Wichita, Kan., to head the following as senior vice president. Frank A. Redinger, in charge company-wide financial services. Robert L. Robinson, in charge engineering, manufacturing and marketing functions.

Garold A. Boush, vice president/marketing, General Control Radio Co., Radcliff, Ky., joined Aermet Corp. as vice president of sales. Philip B. Taylor, formerly Assistant Secretary of the Air Force for Materials, joined a division of General Precision Equipment Corp., Fairport, N.Y.

John C. Ramsey, vice president, Hyman Mfg. Co., Marietta, Ga., joined Lockheed Aircraft Corp., Burbank, Calif.

Kurt R. Manning, a vice president of Aermet Corp., El Segundo, has been named general manager of the newly formed Aircraft Division.

Richard C. Kasperik, vice president and treasurer, Hillman Division of Raytheon Corp., Andover, Mass.

Jack G. Anderson, vice president/marketing, Schlumberger Instrument Corp., Elmsford, N.Y.

Peter J. Schick, formerly executive vice president of The Aero Corp., has formed his own company in Alexandria, Va., to specialize in defense management planning.

Harold A. May, Jr., assistant to the local director of The Metro Co., Baltimore, Md., joined General Instruments Div. as assistant to the president.

Capt. Richard L. Doreau, USAF, retired, assistant to the vice president and chief executive of United Aircraft Corp., East Hartford, Conn.

Stanley M. Harris has been appointed project staff manager in Western Europe for the Systems of the Aerospace Sciences Corp. headquarters in Seattle, Belgium.

George Moore, deputy director of the Personnel Services Agency, Flight Standards Service, Washington, D.C., succeeding George C. Paul who is now director of Flight Standards Service, A-1, Gaithersburg, Md., Moore is now in charge of the Division of Flight Standards Service.

Col. Charles F. Cross, deputy commander and chief, Naval Air Warfare Center, USNVC's Office of Aerospace Research, Washington, D.C.

Baruch Auerbach Corp., Ltd., London, England, has announced the following appointments: Sr. George H. Hines, managing director; R. H. Hines, Vice President, Europe, managing director and chief of operations; Marshall of The Royal Air Force Sir David Boyle, responsible for coordinating the administration of personnel and training and education. Also Sr. George will become: Deputy Managing Director, Aerospace (Aircraft) Ltd. A. W. E. Bough has been named Sr. George as managing director of that company.

## INDUSTRY OBSERVER

►Five-stage Nomad space vehicle is being considered by National Aeronautics and Space Administration's Marshall Space Flight Center (MSFC) in Huntsville, Ala. It would have eight 1.5-megawatt (MW) Rocketdyne J-1 engines in its first stage, eight 200,000-lb thrust Rocketdyne J-2 engines in the second two stages and three on 15,000-lb thrust Pratt & Whitney LR-115s in the fourth stage, and two LR-115s in the fifth stage.

►Flowline designs rocket stage known as Draco it being evaluated by Air Force and NASA for possible use on Altair or Titan II. It is being proposed by Space Technology Laboratories and Bell Aerosystems.

►Growth version of the USAF Minuteman solid propellant intercontinental missile is scheduled to be developed in time to be deployed in late 1970. The ICBM wing. Boeing is to submit proposed final configuration to Air Force Systems Command by Jan. 1 and operational hardware is due to be ready by 1976. Altair's Aerotec heat protection on the present version may be replaced in part on the new version. First four Minuteman wings are scheduled for Air Force bases at Minuteman, Mont., Ellsworth, S.D., Malmstrom, N.D. and Whiteman, Mo.

►NASA is studying a three-stage, solid propellant space vehicle based on its four-stage solid Scout and known as Ram. It would use an Aerojet Junior motor, which produces 57,000 lb of thrust compared with Scout's 114,000-lb thrust Aerojet Senior, as its first stage. Upper stages would be the Hercules-Allegany Astrotec and Altair, which are the third and fourth stages of Scout.

►Scout substage engine for which India is negotiating for possible use in an RF-24 reconnaissance fighter in the VK-7, is expected to offer performance comparable with the Bristol Siddeley Olympus 32, which develops 1,170 lb of thrust with afterburning. Company has seen the Olympus 32 for about 25 lb at its own expense but apparently is not ready to spend more without government approval. India is objecting to paying development costs, estimated at about \$4 million, if it is built in Indian under license.

►General Precision, Inc., has launched a computer-financed research effort aimed at an all solid-state inertial guidance system that would have no moving parts and require no warm-up time. Company has been working on a reaction spin gyroscope under Aeronautical Systems Division sponsorship for several years.

►Some NASA officials believe that astronauts should not begin training for Apollo missions until 18 months before expected flight time. Based on experience on the Mercury program, they feel that the time period is probably part of the system and that Apollo spacecraft engineering should get the major emphasis for the next two years.

►Martin-Baker studies of logistics problems involved in moving large quantities loaded on loaded sailing cars over various routes with loading 23-ft, dia. plastic balloons inflated on low tension. Studies concluded that a booster that large could be moved by road with extremely close route planning, but only if some obstacles could be bypassed and a number of safety lanes were used.

►Latest cost estimates on several major Air Force missile and satellite programs are running considerably higher than those made a year ago. USAF may be forced to request more funds than anticipated for Fiscal 1971 or perhaps have to cut other programs.

►Vought Aerospace is conducting a study of the launch-from-orbit technique for NASA. Study is known as OLO, for orbital launch operations.

►Madr III infrared early warning satellite, launched Feb. 12 from Pt. Arguello, Calif., attained a near-circular circular polar orbit at a 2,128 mi. altitude. Recurrently is 0.600127 and period is 100.95 min. Inertial velocity was 14,266 mph.

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## Washington Roundup

### Military Space

Statements on the military importance of space continue to come from unexpected quarters. James E. Webb, National Aeronautics and Space Administration chief, told a Minneapolis audience last week that if Soviet Russia should surpass the U. S. in space, "these space technologies in its military aspects will jeopardize our security." He said mastery of space is the U. S. in "cosmic warfare."

Four weeks ago, NASA Associate Administrator Robert C. Seamans, Jr., said the same things in the same words (AW Sept. 4, p. 29). Congressmen and military officers have been emphasizing the military potential of space in recent weeks (see p. 28), but such recognition directly from NASA officials is unusual.

Emphasizing Administration policy required leaders of the civilian space agency to avoid reference to military threats in space, partly because the former President objected to the concept of a "war" with Russia and partly for international propaganda reasons.

Questions raised by the recent NASA comments is whether there is indeed a growing appreciation of the military potential of spaceflight or whether this is a part of the Kennedy Administration's talk-tough policy resulting from the Berlin situation.

### GE Satellite Decision

General Electric's abrupt decision to drop its bid for a share in ownership of a commercial communications satellite system (p. 38) stemmed primarily from concerns of its top officials that efforts made by its subsidiaries, Communications Satellite Inc. and another through the hands of those who from government ownership.

GE found itself in an awkward jam in offering charges of monopoly and big-business domination against American Telephone & Telegraph Co.—a corporation that sometimes are labeled as GE itself. First steps now have been a recent blast by a substantial group of industrialists, who sharply criticized the Federal Communications Commission for planning to reserve licenses for GE radio and television stations in the wake of anti-trust judgments against the company.

Bidder for the Satcom-S4 fabrication contract was changed \$500 each by NASA for the voluminous specifications. This is the first time the agency has changed for anything other than construction specifications. The specifications last October's proposal for 446 pages and page size and type size are specified. The fees go to the manufacturers' fund of the U. S. Treasury.

### Naval Cannonade

Common Clarence Cannon of the House appropriations committee, the most powerful budgetary in Congress, came out last night in a bombastic denunciation of the Navy's aircraft carrier, the USS *Enterprise*, by developing the nuclear-powered submarine, "has reduced the greatest swing to the nation of sea, air and space." Then he pointed to the fact that "After spending 15 years and billions of dollars preparing the sea great weapon to be ready when needed, we now find that all the time and money and manpower devoted to this huge, formidable aircraft carrier and the carrier are useless and will be covered up by the secret sea as far as they can go as soon as war is declared or fighting starts. It is the most colossal national debacle in all military history."

Edward C. Walsh, executive secretary of the National Aeronautics and Space Council, will go ahead and try to build a shift in public opinion. He has requested permission to go outside Civil Service regulations on being. He now wants the report next year. Congress voted the extra \$275,000 he requested for Fiscal 1962 but left the timing report on a point of order.

### Anti-Jamming Plan

A crash program to counter any Soviet efforts to jam existing navigation aids in the air corridor in West Berlin is being planned by Military Air Transport Service. Among the moves being considered are installation of doppler navigation and use of lightweight aerial navigation systems aboard MATS aircraft and commercial airlines operating under the Civilian Reserve Aircraft Fleet (CRALF) program.

NASA Administrator James E. Webb has rejected an idea strongly supported by U. S. Information Agency Director Edward R. Murrow—for using the first manned satellite Mercury flight to produce the first worldwide wide-area television broadcast. Translators would avoid being in the line of sight, which would broadcast to an orbit which would relay the images around the globe, using a major propaganda beat on Soviet Russia.

When NASA's latest attempt to put the Ranger 1 into an elliptical orbit causing it to drop into space fell far short of the goal, a question arose as to whether to call it an Explorer (the earth satellite) or a Pioneer (the probe). A project manager suggested a compromise: Explorer 1.

—Washington Staff



As for civil aviation legislation, it differed in Congress both from trying to have the same type of urgency as space and defense bills and from House resistance to backdoor spending.

Private Kennedy submitted to Congress a five-year, \$375-million program of federal aid to airports. His bill would authorize the Federal Aviation Agency to enter into long-term contracts with cities planning airports. That would assure cities that federal money would be forthcoming whether Congress appropriated it or not. The House rejected it then, putting the program on a year-by-year basis.

Separate holders of the contract are

# Miller Opposes Stress on Race to Moon

By George C. Wilson

Washington—Rep. George Paul Miller (D-Calif.), newly elected chairman of the House Science and Astronautics Committee, firmly believes the U. S. space effort should be a step-by-step program rather than a headlong race to the moon.

"The path to the moon is not a sure track," Rep. Miller told *AVIATION WEEK*. "We are following a definite path with food, scientific objectives and we're right on schedule. This doesn't mean we have to pull every possible gun on the moon. Sure it would be nice to beat Russia there. But what's the real payoff in knowledge and information which will add up to a steady advance into space."

"I don't like to think we're behind in space," he said. "I think we're as competitive now scientifically and administratively as when the Russians were. Their overemphasis on race is all wrong."

The conviction that the U. S. should proceed to the moon at its own

pace is shared by the conservative bloc in the scientific community and by many other members of Congress.

The effort of Rep. Miller's views on the House space committee will be felt between now and next January when Congress convenes. Changes in program—more obvious, others subtle—will, among other things, reshape the relationship between Congress and the aerospace industry.

One such change includes formation of long-lasting subcommittees staffed with experts in various space fields, a switch in committee emphasis from broad general topics like this year's hearings on defense research to narrower topics like management of the life sciences program and frequent field trips by the committee and its staff to government and industry space installations.

Under the chairmanship of the late Rep. Charles Bonior (D-La.), the committee was on full committee hearings, usually attended by only a fraction of the 25 members. Present membership is 27. The questioning was tedious.

done by staff people stopped in the subject at hand. Consequently, the hearings often took a meandering, shallow course.

Even so, Rep. Bonior focused attention on a number of space subjects which caught staff attention. He has discussed the hearings, despite shortcomings, did help educate Congress and the public on space matters and helped create what Rep. Bonior called "a sense of urgency."

## Reorganization Planned

But this approach is due for a change. The necessity for long tedious hearings is past," Rep. Miller told *AVIATION WEEK*. He plans to reorganize the committee so that the subcommittees will take lead on specific agencies with space responsibilities such as the Defense Department, National Aeronautics and Space Administration, National Science Foundation, National Science Foundation and the Weather Bureau (AWP Sept. 25, p. 58).

Subtle changes in personnel will include more committee visibility in the field and a more critical attitude externally. These two changes are related.

Chairman Miller does not intend to make the committee a one-man show. This attitude in itself will give the committee a new flexibility. Staff reports will have more authority to block out the terrain. His committee has more opportunity to ask questions since the hearings are under way, and some chance after the hearings to write reports provocative enough to inspire debate on the issues questions arising with increasing frequency, as the U. S. plunges deeper into space.

## Challenge to Firms

One result will be a stiffer challenge to aerospace companies. They will find themselves and their staffs visiting their plants, will have to do on-site homework before hearings, and will find themselves interested more particularly in staff reports. At the time, however, the committee's interested industry spokesmen promises a better approach for the aerospace industry to gain the understanding of lawmakers.

Rep. Elliott Oliver (D-Tx.), one of Rep. Miller's closest associates in Congress, told *AVIATION WEEK* "George Miller, even though he led a lot, is one of the ablest and most respected members of the House." As for Rep. Miller's age—79, Rep. Oliver said. "When they started talking him out of back, the [Rep. Miller's congressional] district he elected into a jet plane and flew faster than sound. And, he's also



Typhon Missile to Enter Fleet Service in 1966

United States Navy's Typhon anti-aircraft missile system under development by Bendix Corp. features very low input into wings with all-weather by control system. Airframe and engine development is assigned to McDonnell Aircraft Corp. Westinghouse Electric Corp. is developing engine development. The missile is estimated to be 500 in. and peak cruise speed 12,000 mph. Typhon is an outgrowth of the Titan anti-aircraft missile and will have extended range, improved accuracy, longer leading capacity and quick reaction capability compared with the earlier system. Test targets can be launched simultaneously by 10 individual missiles, fired under the control of a sophisticated radar system. Typhon concept and preliminary design assigned with Applied Physics Laboratory of the Johns Hopkins University. Missile system is expected to enter fleet service in 1966.

one of the most traveled members of the House."

Another Miller colleague, also a member of the House space committee, and the new chairman's own staff will make little difference if he goes through with his promise to give subcommittees adequate authority.

Twelve got lots of young men on their committees, eager to get into space questions," he said. "There's ready to go. So what difference does it make how many times Miller himself goes to business as long as he gives subcommittees the authority they need to operate effectively."

The visibility of the House committee is in significant contrast to the Senate Astronautics and Space Sciences Committee. Most of the House space committee members are still trying to escape out their political noses. None of the Senate space committee members should have made national appearances in other fields and seldom concentrate on space.

Rep. Miller and he is enthusiastic about his new chairmanship. "The way you see of the committee," he said, "will be to stimulate interest and thought and to play the race of space in the legislative field."

The present space program "is a great one and is very capable launch," said the chairman's role in space. Rep. Miller said, "I'm big enough and should not be enlarged."

As to Rosen's lead in the big hearings field, Rep. Miller stressed it to the U. S. decision to concentrate on man-in-space program. "It is a mistake to make," Rep. Miller said. "It was through inevitable ignorance."

Rep. Miller was born in San Francisco Jan. 15, 1901. He holds a civil engineering degree from St. Mary's College in California. The new committee chairman served as a lieutenant in

the field artillery during World War I.

Rep. Miller began his political career in 1945 when he was elected to the California State Assembly. In November of 1948, he was elected to the House of Representatives. He has been re-elected ever since, having lost Republican opponent in the last election in 1952 to 91,401. The Eighth Congressional District encompasses the eastern half of the city of Oakland and Southern Alameda County.

Rep. Miller considers himself a liberal Democrat and met an early support of President Kennedy. He is a member of the United Methodist Church and Fisheries Committee and was chairman of the Congressional Subcommittee on the subject of the space committee.

## Navy Evaluating Bids For Undersea Robot

Preparations for the fabrication and testing of an underwater search and recovery vehicle applicable to a wide range of operations are being evaluated by the Naval Ordnance Laboratory, Silver Spring, Md. Bids were submitted last month in an industry competition. Details of the vehicle is expected by the middle of next year, tests will be conducted at NRL's Ft. Belvoir, Fla. facility.

Indications are that the undersea vehicle will weigh 1,000-3,500 lb., estimate of cables and auxiliary equipment, and measure approximately 5 ft by 10 ft. It will be required to operate and remain submerged for a period of 8 hr. at a depth of 2,000 ft., in a current of 0.1 ft. per sec. Requirements will be to carry, launch, and recover the vehicle in open sea by a converted lead cable-type vessel.

Vehicle frame will be designed to

rest on its frame along the ocean bottom. It will incorporate a high resolution television camera mounted at approximately 3,500 ft. of cable, which will be the electrical connection between the vehicle's propulsion system, control instrumentation, TV, and tool manipulation equipment, and the controls on the surface ship.

Approximately 100 lb. of manipulator arms and tools will be carried. Tools will be attached to a crane section, and will be changed quickly to the vehicle with winding surfaces extending approximately 3 ft forward of the vehicle where the TV camera's view.

Vehicle will have a sight picture of the bottom, to allow it to see the surface in the event of loss. It will operate in open ocean waters in depths up to 2,000 ft., and its operations will permit the surface operator to move the vehicle up and down, forward and back, and turn in approximately six own diameter. In operation of the bottom, the vehicle will be able to hover, in a more rapid current up to 3 ft. at 1,000 ft. depth or more at a 4 ft horizontal speed in still water at 1,000 ft. At no depth in or on the bottom, propulsion controls will permit maneuverability to  $\pm 1$  in.

## Planet Study Grant

Washington—Stanford University School of Medicine has received a \$500,000 research grant from the National Aeronautics and Space Administration to design instruments for Venus and Mars probes to determine the evolution of life on these planets.

The project, to be directed by Dr. Robert L. Jorgensen, is aimed at studying the metabolic structure of microorganisms. The grant will support research through March, 1964.



Rep. GEORGE P. MILLER (D-Calif.), new chairman of the House Science and Astronautics Committee, meets the White House for a recent visit with the President. Rep. Miller succeeds the late Rep. Charles Bonior (D-La.).



## NASA to Use Industry-Trained Managers

By Edward H. Keleny

Washington—National Aeronautics and Space Administration, faced with a vastly increased manned space flight program and a budget that is expected to reach \$3.4 billion annually in a few years, will announce Nov. 1, putting increasing reliance on young industry-trained engineers and simplified reactor heat

One issue—Dr. Robert C. Scrimm, Jr., associate administrator—concerns the top technical expertise in the space program. Ten field stations which recently reported to three headquarters offices will report directly to him, and all technical programs will be incorporated into four technical offices, also reporting to Scrimm.

The Launch Vehicles Office and Life Sciences Office are being abolished, and their programs will be integrated into the specific flight or research programs they support.

## New Offices

New technical offices and new directors in Advanced Research and Technology, Inc. H. Abbott, new director of the agency's Advanced Research Programs Space Sciences; Dr. Homer E. Smith, Jr., deputy director of Space Flight Programs; Munroe Space Flight Research Division general manager of Radio Corp. of America's Major Defense Systems Division, and Applications, expected to be headed by John J. Baska, executive vice president of the Sylvania Corp., a holding company for electronics (manufacturing firm).

Program directors are responsible for defining technical objectives, developing project and program goals, establishing schedules and evaluating progress.

Thomas F. Dixon, appointed director of the Launch Vehicles Office in August, becomes Dr. Scobee's deputy.

Dr. Scanziani, director of the agency's research and development division, says the agency must effectively eliminate the "parochialized" units within the agency as well as drifting with certain staff project chiefs regarding to individual program efforts. Some in the agency fear that Dr. Scanziani and Deora will be spread thin with direct management responsibility for all programs and criteria, and that the new organization will create more decisions from junior staff members, a Scanziani official Hinescott, another, including NAB's Administrative James E. Wells, feel the new organization will give greater emphasis to the agency's major programs.

Deora says the new program office will eliminate the "parochialized" units. Discussions of launch vehicles and life sciences in various scientific offices

NASA said, does not indicate that these programs are being demarginalized. Projects in the current programs will be split according to mission. Debris will be the top management effort for all NASA launch vehicles except Saturn and Nova, which have been listed to the national space flight program. It is expected that quick handoffs will be established in the four program offices according to mission requirements.

A NASA spokesman and chairman of the environmental Office of Life Sciences is not a crusader in the Air Force or congressional critics of the agency's plans to build a capability in bioastronautics. Although the program is being split, the total number of headquarters bioastronautics professionals will be increased from 11 to 27 during Fiscal 1982.

Criticism of the office began with its establishment in 1959 and has centered around the fear that it duplicates an existing Department of Defense function.

Appointments of Dross and Holmes, and the possible appointment of Burke represent a significant departure from the staff structure of NASA, in which top government scientific officials were made top NASA program managers. Dross 40, was chief engineer of Rockwell's Division of North American Astronautics Inc. The shift to young industrial talent also is apparent in Holmes 40 and Burke, 36.

### Unanswered Questions

The new NASA organization subdivides clear-cut assignments for all the agency programs into one of the four new offices but it leaves unanswered many personnel questions. A number of headquarters people have been assigned both to specific programs and advanced technical development, and these two areas are being separated. The agency expects to complete the organization and personnel assignments this month.

In addition to assignment of new program directors, other major personnel changes already made involve Alvin Silverstein, who was director of Space Flight Programs transferred to Lyndon B. Johnson Space Center as director and Robert R. Gilbreth, whose appointment as director of the newly authorized National Marine Specimen Center was made formal (AW Sept. 25, p. 390). Gilbreth is presently director of the Space Task Group at Langley Field.

Fugent J. Mangano, who has been acting director of Lewis since the retirement of the late Edward R. Sharp last year, will receive his permanent job as assistant director.

In the new organization, Abbott's office sheds its former role of institutional support for Langley, Lewis, Ames and Flight Research Center and becomes a program office for all advanced technical developments and all non-aeronautical programs. This involves a major shift from the current Launch Vehicles Office in programs not related to specific flight missions, and will include nuclear and electric propulsion, supporting research in solid fuel and liquid fuel propulsion, space power technology and power sources.

Also drifting to Abbott's offer will be a part of the life sciences work, particularly the advanced life support systems research.

### Women's Flexibility

NASA did not follow the suggestions of the Women's committee or Project Elevator in establishing a separate astronomical office, because of a philosophy of non-compartmentalizing (AW Sept. 18, p. 25). The agency feels the new organization is flexible enough to conduct additional astronomical research if an increase is required in military or civil relations.

Applications Office will update all weather and communications satellite program activity, which has been split from the current Space Flight Office. Also split from Space Flight are De Newell's Space Sciences and Helmut's Managed Space Flight.

Dr. Niell will be executive director for all unmanned flight programs with the exception of communications and weather satellites. This includes all lunar and planetary programs and scientific satellites and probes. In this category are Ranger, Surveyor, Pioneer, Mariner and Voyager, Inter-Venus Mars missions and the continuing scientific programs to sample magnetic and radiative characteristics. Geological, astronomical and solar observations are in this office.

Space biology programs to determine duration of extra-terrestrial life will be shifted to the Space Sciences Office. Office of Manned Space Flight will direct the overall systems evaluation and engineering for spacecraft launch vehicles, ground support equipment, and tracking and communications networks. Aerospace medicine will be integrated into this office and the director of life sciences programs, USAF Brig. Gen. Charles H. Rosendine, will become one of the key deputies in the

Staff offices and their directors will be: Legislative Affairs, Paul C. Dembling; Plans and Program Evaluation, Abraham Hyatt; Public Information,

O. R. Lloyd, Jr., Technical Information and Education, which was transferred from a program to an executive office. Shelby Thompson, General Counsel; John A. Johnson, Institutional Programs; Arnold Trehan and Executive Assistant Frederick Phillips.

Dr. Sarason's staff offices are Program, directed by D. D. Wyatt, and Administration, directed by Albert T. Siepert, both centers which formerly reported to program divisions now report directly to Dr. Sarason and Throckmush.

Marshall Space Flight Center, headed by Winifrey Ann Burns, and the NASA Affiliated Missile Range launch operations division, headed by Kurt H. Debus, formerly were part of the Launch Vehicle Office.

Formerly under the Space Flight Office was Jet Propulsion Laboratory, directed by Dr. William H. Pickering. Goddard Space Flight Center, headed by Dr. Hays J. Guggenbloom; Space Task Group, directed by Gilbreth, and Wallops Station, directed by Robert L. Knorr.

Under Advanced Research Programs were Langley Research Center, directed by David L. Thompson; Lewis Research Center; Ames Research Center, directed by Smith J. De Haven; and Flight Research Center, directed by Paul F. Biale.

## Soviets Claim World Helicopter Records

**Moscow-Soviet Union** is claiming swift speed and lifting records for fully-crewed. This, the Soviet news agency, and a "living crane" helicopter lifted a payload of 15,000 kg (33,000 lb) to a 2,000 meters (7,000 ft) in set records for payload and altitude with such payload. Apparently this was the Mi-6 living crane at Tashkent (AW 100, 17) is 300.

The previous world record was set in the U.S. when a Navy Sikorski HH-24 flew at 932.9 mph, over a 1.86 mi. straight line course (AOM May 22, p. 35).

### Titan I Is Launched From Operational Silo

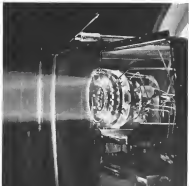
Los Angeles—First launch of a USAF Martin Marietta B-106 autonomous ballistic missile from an operational-type silo took place on Sept. 23. A dummy warhead scored by the missile landed in the predicted impact area west Wake Island 4,500 mi from the launch site at Vandenberg AFB.

First underground branch of a modified Titus I from within a Titus II sub tree, plate from Vandenberg last Mar. (ADP Max 8, p. 30).



### Electrical Propulsion Engines Tested

**Feasible to produce** single-phase electromagnetic engines [also] are motors in working field to produce specific impulses in the range from 1,080 to 7,600 sec. Weiberg is concerned with plasma, produced and accelerated by pulsed power, starting as hydrogen stored in aqueous tanks around the engine. Exhaust velocities lie on the order of 10,000 mph. Pulsing rate can be as high as 16 cycles per second; such pulsations on direct continuous flow of High-Pressure electronic engine [below] was critical as propellant, coolant limited by distance of the return pipe through hot nozzles. Engine will be flown late next year in the form of a series of 10 Soviet helicopter methods with electrical propulsion systems. Higher speeds than 10,000 mph may be achieved by use of direct flow of ionized gas. Single impulse is 6,730 sec. at peak 15,000 psi acceleration. Thrust developed is a function of the ratio of two milliseconds (9.002 Hz) or efficiency of about 62%.





**Boeing-Vertol HC-1B Completes First Hover Tests**

New/Boeing-Vertol HC-1B Chinook helicopter has completed first hover tests of its flight test program. The two-blade helicopter weighed 121 tons during the hover test. The HC-1B is being developed by USAF's Aeronautical Systems Division for the Army.

## Dr. Charles Herzfeld Appointed as Project Defender Coordinator

Washington—Advanced Research Projects Agency has named Dr. Charles M. Herzfeld as coordinator of its new Project Defender program. The Defense Department's advanced research effort for infinite missile defense. Herzfeld, a 57-year-old physicist, comes from the National Bureau of Standards where he was an assistant director.

Herzfeld also will direct personally two of the four major technical areas under Defender. The remaining two will be under Albert N. Rosenberg, who previously directed the entire program.

The move reflects the growing maturity of Project Defender programs which began Defense Department direction. Defender is the largest program in ARPA headed for \$104 million in current fiscal year which represents about 55% of the agency's total budget.

Data on ballistic missile re-entry, related to this, under Project Defender has been used to enhance the ability of Nike Zeus to intercept intercontinental ballistic missiles and other types of re-entry vehicles. ARPA has been asked to select its own in the proposed refinements of Nike Zeus for use by Defense Department in deciding whether to recommend introduction of the Nike Zeus missile system.

for Project Defender. The Project Defender program currently encompasses three main areas: research, development and testing.

• **Research** to include basic knowledge of the atmosphere and ionosphere. For example, ARPA is sponsoring the study of 1,000 ft-altitude ionosphere conditions in Pacific Basin which will be used to measure electron density.

• **Missile phenomenology**, a term applied to the dynamics of a test on the behavior of ICBMs of launch and test vehicles during a test by measuring their electromagnetic radiation over a wide portion of the spectrum of various altitudes. Initial experiments were made in a specially constructed drop, the USS Murre, but for more realistic facilities are now under construction on Rongerik Island near Kwajalein, in the Pacific (AW Aug. 17, p. 61). ARPA has a small site for making such measurements at the Naval Air Station and Space Administration's Wallops Island facility.

Next, half of the Project Defender funds are allocated for the missile phenomenology portion of the program, which involves test facilities.

• **Components and techniques**, with its inherent radar, electronic and other devices especially used for ICBM defense, which are not being developed

for other uses as other agencies. Typical of this effort is the electronically accessible area radar (ESAR) developed by Boeing Corp. ARPA also is funding advanced work in optical radar (laser) and plans to increase its program in this field.

• **Systems**, intended to explore the feasibility of using existing ICBM defense concepts and to provide, and test, as well as what new components and techniques are needed. Two such programs now under way include ballistic missile launch intercept, known as Bore, and ARPA's current defense, known as Aegis. The former includes active contracts with General Space Technology Laboratories and Hughes Aircraft (AW Aug. 26, p. 25; Nov. 1, p. 13). The Aegis work, given direction in Washington, with Hughes Boeing and International Business Machines Corp. as subcontractors (AW July 3, p. 28). Lincoln Laboratory also has a major role in evaluating new techniques.

The research and missile phenomenology portions of the Project Defender program are under the direction of Herzfeld while the components and techniques and system portions are under Robertson. Herzfeld's own title is Assistant Director for Infinite Missile Defense Research.

Officials at ARPA believe the agency has sufficient funds to support itself, which, investigations in the ICBM defense field and that no such financial assistance as that to support such research is available to the nature of the threat and its environment.

## GE Drops Satellite Bid

Washington—General Electric has withdrawn its proposal for joint ownership in a commercial communications satellite system, leaving the field to existing communications common carriers.

GE Vice President Dr. George L. Hollis, in a letter last week to Federal Communications Commission Chairman Newton Minow, said that the company was dropping its Communications Satellite, Inc., formed under the name of a common law partnership and operation of a commercial communications satellite system and withdrawing its request for FCC licensing. Hollis, who heads GE's Defense Electronics Division, was chairman of the board of Communications Satellite, Inc.

Hollis and the company felt that the President's decision to encourage the establishment of a privately owned communications satellite system is quickly as possible in a manner consistent with the public interest. It is noted that the move to the U.S. will not be attempted by GE, which has been offered opportunity to be first.

The letter and GE had reversed its position shortly after the light of the increased national space program and had decided not to direct its resources into the current communications field but to concentrate on its traditional role as a manufacturer of space vehicles and related equipment.

the telecommunications field of the future to itself, the treaty dates to December, 1959, by the International Telecommunications Union.

U.S. is now making arrangements aimed at obtaining frequency allocations for its operational space stations—satellites and communications—by the 1961 conference of ITU. It would be on a point facing to prevent its rise to the overwhelming majority of countries more interested in allocation for political broadcasting if the space research already already available had not been approved.

Until the treaty was ratified last week, National Aeronautics and Space Administration was also added with careful of its role in negotiating, together with other nations, for frequency for space research program.

The Defense decision opening the way for utilization was characterized by the agency responsible for implementing it as being from Defense to Intelligence, Radio, Air, Navy, Committee, to Federal Communications Commission, to Sec. William Douglas (D-Calif.) chairman of the Senate Foreign Relations Committee.

## ADC Grounds F-106s After Trio of Crashes

Casualty F-106 Delta Daggers have been grounded by the USAF Air Defense Command as a precautionary measure following three crashes out of them last week. ADC will order repairs to training and transition flight and does not affect the emergency capability of units operating the aircraft. Presently, these units would be able to do the order since they will not engage in practice attacks until the grounding order is lifted.

The exact cause of the accidents has not been determined at this time. ADC and adding that investigations are under way in a standard procedure in case of a series of unexpected crashes. The three accidents which precipitated the grounding occurred at Meigs AFB, N. D., Rensselaer, and at Gieger Field, Spokane, Wash.

No definite cause has been found for the accidents nor does there seem to be a trend in them. The first crash, at Spokane occurred while an F-106 was in final approach for landing. The second accident, which occurred on the ground, had what appeared to be a normal approach.

The third crash, which applied to all models of the Delta Dagger and will remain in effect until danger causing the crashes has been determined and corrected action taken. Investigation in these cases will be no trend established in the three crashes is entirely possible they are unrelated. ADC and

Western Electric has received \$271.8 million contract from Army for construction and development of Nike Zeus ICBM defense missile system, including initial funding for the program to date to more than \$1 billion. Douglas Aircraft, under Zeus subcontract, will receive \$27.7 million of new award.

Charles E. Wilson, 71, former president of General Motors Corp. and Secretary of Defense from January, 1955 until October, 1957, died Sept. 26 at his plantation home near Norwood, La.

Kenneth has received \$42-million Navy Bureau of Weapons contract for additional production of Sparrow III anti-air missiles, part of special one-year program appropriation for stepped up defense production.

William C. Foster, formerly head of the Gathier Corporation and president of United Nuclear Corp., has been named to head the U.S. development research established by Congress at the request of President Kennedy. The agency staff organization with a staff has been led by Foster, 1962, \$1 million from the transfer of State Department funds and \$1 million in supplemental funds voted last week by Congress.

Tactical Air Command has transferred eight additional squadrons—two equipped with Lockheed F-104s and four others with North American F-100s—to the 17th Air Force as a "transition" assignment. Purpose of the transfer was officially described as "to meet operational needs."

West German air force publicly displayed its Lockheed F-104s and F-4s. In the first time last week at an air show in West Germany, the force was estimated at 300,000 people.

Deutsche Luftwaffe West, Germany, is expected to use its own-made concept of management that track and name an operating product at its top executive during the current "stockholder" meeting in Cologne in the next few days. The post in West Germany's controversial mission of transport, from Stockholm.

John A. McCone, former head of the Atomic Energy Commission, was announced last week by President Kennedy to succeed Allen W. Dulles as Central Intelligence Agency director.

White House-appointed commission panel (AW Aug. 26, p. 16) will meet in Washington, D. C., this week to hear a NASA briefing on the subject and to be able to see the people's activities in the next few months.

# Chances for Promotional Fare Plan Slim

Lower North Atlantic rates proposed in mail ballots but approval before winter slump hike is doubtful.

By L. I. Doty

Washington—Rebottle to a Pan American World Airways proposal for promotional fares on North Atlantic routes, designed to compensate wide regional airline differences as tariff rates, demonstrates that international airlines are still far from as agreed as rate reduction.

In a last ditch move to introduce an incentive fare that has international Air Transport Union traffic meetings failed to produce, IATA's Director General Sir Frank Whitehead submitted the Pan Am plan to member airlines for a mail vote.

However, it appears that results of the voting will fall far short of the unanimous approval required to put the plan into effect once the calendar will move into the low traffic winter season without the promotional fare plan carrier vote.

Pan Am has proposed that groups of not less than 25 passengers not travel round trip across the Atlantic on scheduled jet flights at equal fares less \$400 throughout the year. Between Apr. 1 and Sept. 30, group round trip fares would be allowed on peak season at \$177 less than regular rates. Between Oct. 1 and Mar. 31, on peak season rates would be \$165 less than regular fares.

The group fare principle generally supported by international airlines is aimed at offsetting the decrease of traffic from scheduled operators in winter flight which have been going up significantly in popularity during the past few years. Attempts to adopt a group fare plan for the North Atlantic in recent traffic meetings in New York and London last summer (ENR Aug. 7 p. 16) failed because of sharp division over winter rates.

## 'Affinity Clause'

Superficial objections also appear likely to doom the Pan American plan. For example, one major carrier which has insisted that the group fare include an "affinity clause" in spite of its apparent responsibility for decreasing the traffic meetings—has been considered this point in the Pan Am proposal.

But that carrier now says it will not agree to the plan because it fails to allow groups to book up within Europe since they have reached the first point of arrival. The affinity clause requires that groups must have some identification as an organization. This is to prevent travelers from forming a group

which has the purpose of gaining the advantages of the low fare.

Pan Am, in its proposal, also withdraws its earlier demands that groups be, as agreed to make two steps during a year to qualify for the group fare, another possible reason for the lack of agreement.

Specifically, the reaction report from the statement of one carrier that it is "a case in the process of discussing the plan" is that of member which charged that Pan American had violated its duties as a member by acting on rates that could not be reached until one year later, and that such will not be settled in correspondence.

## Another Effort

The first problem now probably will turn up in a mail vote at the last conference IATA annual general meeting this month in Sydney, Australia. At the time, another effort undoubtedly will make an extensive effort to win group agreement on the group fare plan, but not attempts to settle traffic

conference differences at general meetings here and abroad seem imminent.

On the bright side, one major flag carrier said that the proposal "at least has a plan on the table" and that the deal it can make possible members which could be used for the proposed mail or acceptable plan. Another factor that could bring about an eventual agreement on the group fare is the general loss of the declining mail. Extra anticipated for the furthering winter season. Many carriers recognize the immediate need for a plan that will have traffic volume.

Intended effects of the Pan American plan in Nov. 1, that the schedule for holding in a light that failure to approve the plan would delay the effective date will into late winter if it is accepted to the satisfaction of all members. Before any final return in IATA's no later than Oct. 31.

If it is agreed by all 17 carriers, the vote will be held Oct. 12 and 13 with the governments of the airlines involved for formal approval.

## Compromise Attempt

In submitting its proposal, Pan Am stated that the plan does not, and should not, contain any of the usual conditions of all rates, including the fact that it is not brought out at the special New York and London rates. It stated that the plan is based on the discounts at those meetings and is designed to provide direct carriers, in a general way.

The proposal specifies that the group fare will be available to "members of the same association, corporation, company or other legal entity" which shall have prearranged, prepaid, and tickets, and other travel.

To broaden the group market, Pan American further proposed that operators, group travel organizations, or the sub-agency of the fare, provide that each member of the group has belonged to it for at least six months prior to the starting date of the trip. Members may include their immediate families in the trip at the special rate.

All members shall be required to travel together for the entire duration. This condition does the support of seven carriers of the London meeting, but five carriers argued that group members should be permitted to travel individually except during on-board and on-board legs of the full itinerary.

Solution of travel group would be limited to personal letters, credits,

and telephone calls addressed directly to members and to publications included for circulation within the group. Airlines could be permitted from selling groups in "public advertising" which is defined by Pan American as involving the group feature in advertisements or any other writing or means of public contact from either paid or unpaid. Use of telephone campaigns, radio, television and television to select group members would also be prohibited.

Airlines with limited sales outlets within the U.S. are likely to protect this portion of the plan, although the Civil Aeronautics Board will undoubtedly insist upon a condition before giving its approval to any group fare rule.

As a concession to carriers concerned over the discounts effects of the group rates, Pan Am proposes that calendar year of flying, Mar. 1, June and July and September, travel during August, September and October across the North Atlantic under any itinerary may not be started between 7 a.m. Friday and 7 a.m. Monday.

Other features of the plan include:

- Full payment of all tickets must be voluntary by the carrying airline 30 days prior to the flight.
- Peak ticket must be retained in show of the passenger is a bona fide member of the group.
- Group travel organization shall make it a condition of its membership to its eligibility to the group fare.
- A discount after shall be entitled to receive and obtain information from any member of the group.
- Group fares shall not be used for connection of non-scheduled fares.
- Reduced rates for children may be applied to the group fare.
- Free or reduced fare transportation for a driver conductor will be prohibited.

## Ox Carts to Airplanes

Washington—Senators Antonio Rubio, Senator Chien-Chi, S. Mike Monroney (D-Idaho) has now introduced a bill for reformulating the current aviation transportation system. The bill aims to improve without stopping to build millions of dollars of highways.

In a recent hearing, Monroney noted that rather than build highways in justice to the people, the government is spending billions of dollars to build the individualized countries, "a few airports and modern international roads" which have been a constant problem to the future.

He added that rather than build highways in justice to the people, the government is spending billions of dollars to build the individualized countries, "a few airports and modern international roads" which have been a constant problem to the future.

# CAB, Justice Reappraise Policies On Foreign Carriers Competition

Washington—Civil Aeronautics Board, with the help of the Justice Department, is reviewing its policies toward foreign carriers in hopes it can develop stop-gap measures to improve the competitive position of U.S. lines in the international market.

Reel actions under consideration include setting up restrictions on foreign carriers, offering U.S. flag carriers to enter into pool arrangements to meet some traffic which is unprofitable, and letting U.S. carriers run into foreign carriers.

There would be no change, steps to give U.S. carriers temporary relief. The measure would be approved by the CAB, U.S. policies now being ordered at the discretion of President Kennedy.

Impact for new aviation policies comes from the widespread contention that the U.S. government is not doing its part in the face of international competition for air traffic. Those a dissatisfaction with the bilateral agreements with foreign governments and with the U.S. government's inability to protect its U.S. carriers from foreign competition as they are in the same agreements.

Both government and industry witness at a recent hearing before the Senate aviation subcommittee said the situation will become worse unless prompt action is taken. Chairman S. Mike Monroney (D-Idaho), for example, said the competition from foreign carriers will become steadily more fierce unless effective action is taken.

"We would be blind indeed," Sen. Monroney said, "if we ignored the likelihood of a strong air traffic flow to our carriers coming from Asia, rather than toward the U.S. as being one of the thrusts we face." He added that the Senate could "all afford to sit here and let the air transport world in there and the competition that has developed through the years in the maritime field."

CAB Chairman Allen S. Boyd noted that the U.S. carriers' share of international traffic declined from 74.7% of the total in 1970 between 1950 and 1960. Part of the trouble, he said, stems from CAB's inability to enforce provisions of U.S. air agreements with foreign countries. Aviation policies, he added, in this field of CAB's authority, are negligible international as they even when it falls a foreign carrier's law will hurt U.S. lines. Legislation giving CAB the authority was not acted upon by Congress this year.

Boyd said the CAB has not been able to keep foreign governments from using subsidies on U.S. carriers. "One reason," he said, "is to judge final complaint of violation of the agreement, but pending the conclusion of consultations for the sake of compliance or are operating on the other government's laws."

To strengthen CAB's role in international matters, Boyd and the Board "are now considering the legal and policy issues that will be required to protect the interests of the U.S. carriers in foreign carriers."

Boyd said "we are becoming increasingly concerned" with the foreign airlines' policy making that the carriers divide up the market among themselves. "It is apparent that a number of these [pool] arrangements involve violations of the anti-trust laws of the U.S. and Canada."

The Board has asked the Justice Department to determine whether U.S. carriers forming similar pools would violate the anti-trust laws, he said. "Based upon its interpretation of the Federal Antitrust Act, has approved U.S. carrier participation in such pools because of their growth, stabilizing effect on competition," Boyd said. "But it may be that continuing study of the matter and future developments in this field will indicate the need for a re-evaluation of this policy."

Calling "increasing protection" by big foreign carriers into smaller ones during periods of overcapacity and low oil prices, Boyd said the Board is considering actions opposing the worst type of membership by U.S. carriers any time to be changed.

Edmund M. Martin, assistant secretary of the Senate aviation subcommittee, said that the objective of the U.S. for enlightened leadership in the development of international air transport is being to show that the competition that has developed through the years in the maritime field.

Martin indicated the private study of international aviation problems requested by President Kennedy. Martin said the market contract is expected to cost between \$225,000 and \$300,000 and the study is expected to take nine months.

He said that the private aviation subcommittee will conduct its own study of international air problems between now and when Congress reconvenes. Sen. Monroney said he will hold hearings early next year on international air agreements.

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## Northeast Balks at Terms for Merger

New York-Northeast Airlines' "iron bound" favored dealmakers" will accept changes in the reorganization, because proposal made by Eastern, National and Northeast (AW Sept. 25, p. 15) to reflect Northeast's delay in agreeing to the plan, a representative of the three carriers said.

Outlining a Sept. 20 deadline for decision that Northeast—which has no more objections to some aspects of the proposal—failed to meet the three carriers' terms, Northeast Chairman Ben A. Storch said. "A specific favored consideration involved in the offer must be subject to adjustment reflecting the delay."

Last week, Northeast refused to meet on the merged financial position for delay, but said that prompt and proper consideration would be given to the extended proposal. Because of the difficult questions concerning legal and practical feasibility of the plan, it has been referred to legal counsel but to review and recommendations, Northeast said.

Expanding obligations to meet with representatives of the three carriers, Storch said, in a statement that CAB had already made a Northeast merger a subject of consideration in the past. "Northeast must proceed and that the three carriers' position as well as any others would be considered and its merits."

Moreover, Storch said, Northeast's annual application is being regularly opposed by Eastern and National. "We desire serious review," Storch Sept. 22 and advised that the three carriers, dated Sept. 15, had not been received and the financial condition of Northeast continues to deteriorate. "Hence, the proposal would be withdrawn under 5 p.m. Sept. 22. Storch indicated "our acceptance of any and every willingness to recommend such a proposal, in principle, as chairman of Northeast and president of Adu."

Storch replied Sept. 26 that the deadline was inconsistent with the three carriers' stated intention to have the offer open for a reasonable time. Northeast had had about one working week to consider the complex proposal. Storch said. "There are serious unresolved questions as to the legal and financial feasibility of the proposal," Storch said. "There is no doubt the proposal that only specified obligations will be assumed by the merged company, and only specified assets applied in obligations are assumed, leaving Northeast with the burden of satisfying obligations. (The proposal), among other things, would alter the merged com-

pany of \$26 million of debts that are held by Eastern and National. The three carriers would not be responsible for Northeast's trade accounts outstanding."

Storch also said the proposal does not resolve difficult questions relating to the relative rights of creditors or rights of stockholders in relation to such creditors, a subject to conditions over which Northeast has no control and is presented in major part. "The issue is not to create any new economic condition in the transportation in the territory served by Northeast."

Regarding the New England routes, the proposal would require Northeast to assume the Northeast's routes south of New York, the airline is "as an asset prepared to consider" the transfer of assumed economic condition in all transportation.

Practical problems in connection

## Examiner Approves Riddle Merger

Washington—Merger of Riddle Airlines and American and American, which would give Riddle through-plane cargo service from interior U.S. ports into 11 Latin American countries, has been recommended by Civil Aeronautics Board examiner.

If the merger receives approval of the Board and the President, the American route would give Riddle access to certain ports in Central America, the Caribbean, the South American countries of Colombia, Ecuador, Peru, Venezuela and a point in Brazil.

CAB Examiner James Keith found that the two systems, which meet in Miami would "integrate perfectly." Riddle currently holds authority to operate domestic cargo flights between Miami and Boston via New York, Philadelphia, Baltimore, Washington and several Florida ports. Another segment allows Riddle to fly between Miami and the continental United States via New York, Philadelphia, Cleveland and Atlanta. Riddle also has a New York-Miami-San Juan, Puerto Rico route.

American is operating only over portions of its national route system. Its one open route two flights weekly between Florida points and Ecuador, on the Canal Zone, and a weekly flight between Florida, El Salvador and the Canal Zone. Riddle had indicated that the merger would be a "one-way" would operate only on part of the American system.

With the proposal, Storch said, include the transfer of assets which would be involved in carrying out the plan. Storch said Northeast is not now in a position to commit itself "because of the uncertainties inherent in some proposal, the nature of the conditions which you have specified and the short period of time which a new proposal is for consideration of the problems involved."

Answering Storch in a letter dated Sept. 27, the three carriers described Storch's objections as "for the most part a compilation of problems unrelated to our merger." They are reorganized the current need in improving service and efficient handling on both sides.

The offer of Sept. 15, the carriers said, is not withdrawn and is continued in effect until further notice. But the financial conditions, they stated, must be subject to adjustment because of the delay.

## Examiner Approves Riddle Merger

The American Airlines, Russell Airways, and Panagra opposed the merger, as the grounds that it would give Riddle a competitive advantage.

Pan-Am, Russell and Panagra have raised some doubts about Riddle's ability to operate profitably over the American system.

In rejecting the proposal of Pan American and Panagra, Keith stated that the merger would give Riddle access to certain ports in Central America, the Caribbean, the South American countries of Colombia, Ecuador, Peru, Venezuela and a point in Brazil.

Keith said that the merger would give Riddle access to certain ports in Central America, the Caribbean, the South American countries of Colombia, Ecuador, Peru, Venezuela and a point in Brazil.

Turn of the merger call for Riddle's offering to buy American stock at \$1.37 per share plus common stock and \$6.175 for preferred stock. American has 146,238 shares of common and 20,085 shares of preferred stock outstanding. American stockholders could exchange common stock for Riddle common stock on a one-to-one basis. One share of American preferred stock would bring 54 shares of Riddle common stock. If all shares of Riddle common stock are sold, the merger would be worth \$31,035. American currently owns one DC-4 and one C-46 aircraft.

## Changes in MATS' International Service Rates Proposed by CAB

Washington—Changes in MATS' Air Transport Service rates for international operations have been proposed by Civil Aeronautics Board after a survey of the airlines' charter industry's operations under minimum rates set a year ago.

CAB set the minimum rates on Oct. 1, 1966, after an extensive period of study. The rates were set to be based on an average estimate for minimum rate determination in the light of one year's experience. CAB said in its report that the rates were set to be based on an average estimate for minimum rate determination in the light of one year's experience.

The Board asked contractors to submit figures for operating expenses and expenses for the first year of operations under rate policy. It also requested proposals for operating expenses for 1967 reflecting the use of turbine-powered aircraft such as the Canadian CL-44 and Boeing 707. MATS now also asked to include an estimate for the cost of fuel, which would be set at a level of 10 cents per gallon.

As a result of the study, CAB made recommendations that changes of maximum rate policy be made in four areas: •Maximum rate level. The impact of higher, more commercial turbine-powered aircraft on the MATS charter market has led CAB to propose low rates for certain MATS operations. Proposed maximum rate for rechartering operations is 27 cents per passenger mile. The previous rate is 9 cents per passenger mile. The present one-way rate of 42 cents per passenger mile would remain because CAB feels it is properly related to operating costs. Round-trip rates should also be reduced.

## PanAm Helicopter Hits Snag

New York—Negotiations between New York Airways and Pan American World Airways over operation of a helicopter planned to tip the 17-story Pan Am Building, which construction here have been stalled by a dispute over clearance of the helicopter's tail rotor.

PanAm wants authority to restrict the number of charter services New York Airways would be able to provide for PanAm's transportation in connection between Midland and the Manhattan heliport. New York Airways, on the other hand, doesn't want to serve PanAm passengers elsewhere in the charter operations operated at certain times in the day to connect with commercial flights. Clearance waiver services are not involved.

PanAm has already signed an agreement with Grand Central Building Corp., owner of the building, under which PanAm will pay half the cost of the helicopter. But New York Airways, if it is to be the operator, is in a difficult position to be bound by a third party to the agreement, and is unwilling to have linked to the degree of cost allocated to it.

PanAm probably will conduct another helicopter on its own terminal at Midland if it can have direct service between it and the midtown New York facility. The airline's chief lines of space in the PanAm Building, which is scheduled for completion in 1968.

be dropped from 15.75 cents per ton mile to 12 cents. On one cargo, that rate would be lowered from 22.5 cents per ton mile to 17.5 cents. Conversely, passenger mail, and cargo the other charter rate for road travel would be 13.5 cents per ton mile instead of 16.5 cents.

•"Overweight" flights. Round-trip flights, with a maximum of 100 miles of the trip where the aircraft travels empty—have been a long time problem for MATS. These "open" flights are now contracted at the one-way rate for mail. Proposed rate changes would make this type of operation a round-trip flight for use passengers, subject to their limitations.

One limitation provides that round-trip flights may not be made at any point over 200 mi. from the point of which the flight originated. This will allow the airlines to use different airports in the same general area without extra costs. CAB figures that the current rates need not be up there that would have to bring the aircraft to and from the point of origin area.

Another limitation provides for a maximum time for flight on route, not to exceed 50 minutes. This would allow round-trip flights to serve in four round-trip flights. The final restriction is a provision for a four flight on route not to exceed 100 miles in one-half the time.

•Rate making authority. MATS used as a basis for minimum rate calculation the cost of a round-trip flight from New York to New York via New York. This is a very low rate for a round-trip flight. The cost of a round-trip flight from New York to New York via New York is a very low rate for a round-trip flight.

charter. Pacific airlines would be based on a minimum round-trip flight time in either Africa or Hawaii (which are in the distant distance).

•Minimum rate basis. Provision will be made for specification of minimum rates based on additional types of aircraft as they become available for use.

The new rates, if adopted by the Board, will affect PanAm 1967 MATS contracts but not for 1968. Contracts will be a change according to rate increase in the event the CAB makes any change in rate policy. CAB hopes the new rate policy will allow charter rates to be based on a minimum round-trip flight time in either Africa or Hawaii (which are in the distant distance).

## BOAC Opens Appeal On Canard Decision

London—British Overseas Airways Corp. last week asked its appeal against a British Air Transport Licensing Board decision in favor of allowing Canadian Eagle Airways to operate from Boeing 707-130 from London to New York City.

BOAC's appeal states that a drop of 11% in transatlantic traffic this summer under last year (AAW 14 p. 5) and that the costs of Canard Eagle flights will be a significant factor in the decision of traffic from BOAC.

BOAC also contends that the latest grant to Canard Eagle is a major decision, an almost previous one since the board's decision in 1965. These would be used to determine from BOAC's view of that the decision will be a significant factor in the decision of traffic from BOAC.

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## Jet Transport Skids Into Harbor at Boston

American Airlines Boeing 707 turbofan transport with 71 persons aboard last week skidded a 7,500-ft runway at Logan Airport, Boston, and was 400 ft off the field into eight feet of water in Woburn Bay, coming to a stop some 100 ft from land. All persons aboard were rescued by pleasure boats in the area.

Plane skidded about 40 ft on landing, veered to the right across land for an estimated 100 ft before skidding into the harbor. Pilot of the aircraft, Captain T. E. Jensen, rode the landing under maximum conditions in foggy weather. The accident occurred at 11:30 am, Sept. 14.

Both prop engines, nose wheel and landing gear were ripped from the damage when the plane hit the water.

## Consortiums Urged for SST Development

Delhi, Holland—Political and technical consortium agreements between Western European nations and the United States should be reached by 1970 to speed development of supersonic transport aircraft, George Hertz, president of PanAm's South America division.

The company president is developing a Mach 2.4 supersonic bomber (see p. 15) as a civilian aircraft.

Delivering the Albert Einstein Memorial Lecture in Delhi, Holland, Hertz declared to side with other factors in the current debate over regional performance for such an aircraft—Mach 2 plus as the British industry contends, or Mach 3 plus in most U.S. spokes men declare. He said, instead, there is a need for the U.S. Europe consortiuming upon a Mach 2.2 "transonic" aircraft, the one that the U.S. space a Mach 3.5 "transonic" transport. He told the Delhi audience.

"It would seem that in the matter of supersonic aircraft, there are two potential fields."

•"An aircraft seating roughly 100 passengers, economical to operate over distances of from 1,250 to 2,000 mi. and capable of flying at Mach 2.2, i.e., non-attachable with the 2,000 mi. as the present transonic aircraft. Such an aircraft would be called 'transonic'."

•"A 'transonic' aircraft which, at cruising, is preliminary calculations would pay at any day it was made to fly at a speed of roughly Mach 3.5 and would thus be able to operate in place of today's aircraft."

From each of these, Hertz said, would be such that "no single aircraft construction or new single group of aircraft construction" [would] be able to make such enormous gains, for the performance of supersonic aircraft is not only a matter of technology but also of economics that relatively few of them are ever needed." He estimated development costs for the Mach 2.2 aircraft, including instruments, equipment, engine, fuel, and other costs, at approximately \$400 million. Similar costs for the Mach 3.5 transport would be about \$600 million, Hertz said, adding:

"There is one simple conclusion to be drawn from all this: that in this particular field, private enterprise must give way to an innovative organization. I should like the West to realize this and to endeavor accordingly a work of substantial cooperation in the international level."

On the European side, Hertz said, the French and British governments "could draft the central features of a common plan with which the government of the United States could join in the West-Belgian."

Germany, Holland, Italy, Spain, Sweden and Switzerland would become a second.

French and British government and industry spokesmen have been discussing such an agreement for some time now with no positive results thus far. As a possible preliminary compromise, the British and French governments have agreed to a joint study of the British Aircraft Corp., which recently completed the design of a 140-passenger Mach 2.2 transport, a highly efficient design with a wing resembling that of the Harrier, Stage 115, transport plane (AAW 15 p. 47).

In his speech, Hertz said, "The manufacturers are unable to take this new business" toward cooperative development, although in France and Denmark, named by the government to cooperate in a supersonic transport, approaches have not yet been able to agree on a uniform design.

"The manufacturers have accepted that supersonic aircraft is a new field for governments to speak," Hertz said.

Once the European consortium has been arranged, "a second consortium would then follow between the European governments on the one hand and

the U.S. government on the other to decide and allocate the work in the project in accordance with U.S. government understanding to support the transonic project and Europe's own transonic project."

Both American and European consortium would have complete freedom of initiative.

Hertz, however, is possible reference to the world's shortage of revenue of the Boeing 707 transport and other aircraft has made since Canard's market since. And down is sharp dividing line between the two efforts.

"The agreement should be made that an state of they might recover—whether directly or indirectly—must serve to promote such overall cooperation of efforts as would ensure that two sectors of aircraft, both common, were created with the transonic transport for Europe and the transonic transport for the U.S."

Most U.S. discussions in this field involve huge amounts of government aid, both in money and design contributions, to its own European counterparts.

## Reverse Thrust Landing Method For DC-8s Is Ordered by FAA

Washington—Federal Aviation Agency, acting after a series of accidents in which DC-8s landed on taxiways, has ordered that all DC-8s must use reverse thrust on landing. The order was issued after a series of accidents in which DC-8s landed on taxiways, has ordered that all DC-8s must use reverse thrust on landing. The order was issued after a series of accidents in which DC-8s landed on taxiways, has ordered that all DC-8s must use reverse thrust on landing.

Reverse thrust should not be applied until all of the transport's wheels are firmly on the ground, the FAA directive said. Guidance (which should not be reversed until the DC-8's pilot maintains the aircraft's speed, engine speed, and other factors) should be used to produce reverse thrust, it warned.

On the DC-8, a series of lights under the flight crew's feet when the aircraft's thrust reverser brakes have been applied, should be used to indicate that the aircraft's thrust reverser is producing reverse thrust, it warned.

safer with brakes locked on its side, or with nosewheels rolled at sharp angles. The FAA said it would not allow any aircraft to land on taxiways unless it had a reverse thrust on landing. The order was issued after a series of accidents in which DC-8s landed on taxiways, has ordered that all DC-8s must use reverse thrust on landing.

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Microfilm, at Hialeah's direction, FAA as carrier operators are going short-term to an instant-week sample of DC-8s operators to determine which airlines have trained their pilots adequately on DC-8 hydraulic outboard procedures.



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## American, Flying Tiger File Cargo Tariffs

By James D. Herlihy

New York-American Airlines and the Flying Tiger Line have filed separate proposals with Civil Aeronautics Board for new air freight tariff structures each carrier taking a different approach to the long-standing problem of air cargo volume growth rates.

American's proposal, a streamlined and highly simplified "single rate" covering virtually all commodities and offering volume discounts and lower rates for non-peak shipping hours, will go into effect Oct. 23, subject to CAB approval.

Flying Tiger has proposed a new tariff structure which retains rate differences for types of commodities but provides for an overall lowering of hundreds of rates on many items from a general average of about 184 cents per ton mile to 134 cents per ton mile. Flying Tiger wants to put the new rates into effect Oct. 16.

While CAB has not officially approved either proposal, the board in the past has publicly encouraged carriers to seek new methods for increasing cargo volume.

American executives toward their proposal as an "attempt to bring order and simplification into air freight tariffs" pointing out that the actual thousand commodity rates now in use cover, left-handed as moving an freight line official said, that American expects its rates to remain in approximate the same level under the proposed new single rate structure even without an increase in cargo volume, although the line hopes to attract more volume with the new tariff. American grossed about \$25 million from air freight in 1968 and has experienced record high month this year. An August carrier lugged more than 11 million ton miles of air freight, a monthly record for domestic carriers.

The "single rate" tariff was developed by American after 18 months of study, using electronic data processing equipment to establish uniform, point-to-point rates, volume discounts, non-peak discounts and other standards. The proposed American tariff structure is based on:

- **Volume rates** which decrease as distances of distance increase.
- **Directional rates**, which follow the traditional air freight principle of lower rates for eastward shipments compared with westward.
- **Volume discounts** for large shipments. These range from 75 cents off per 100 lb for 1,000 lb shipped over distances of 981, 1,000 miles to \$4 off per 100 lb for 10,000 lb shipped more than 1,980

miles. Discounts from the rate per 100 lb are provided for cargo loads of 1,800, 2,800, 3,000, 4,000 and 10,000 lb.

A **directional rate** for shipments received at the airport during the non-peak air freight hours of 9 a.m. to 3 p.m. on major freight routes. Discounts of 25% off the proposed single rates will be offered on non-peak shipments between New York and Chicago and between Los Angeles and San Francisco and Boston, Cleveland, Detroit, New York or Chicago.

**Expense C.** Tariffs. American's one proposal, under the single rate, Flying Tiger will result in lower rates than now offered on some commodities and higher rates on others. He added that volume discounts applied would be enough to offset any loss of revenue from shippers who will have higher rates at the proposed goes through.

The only commodities excluded from the single rate in American's proposal are such items as materials which require special handling and will bear higher rates than the standard, and a few perishables such as flowers and vegetables, which will draw lower rates.

American officials listed three examples of the proposed single rate: \$1,000lb shipment from Los Angeles to New York, will cost \$17.00 where presently the charge ranged from \$15.95 for commodities such as nuts and bolts to \$24.50 for some chemical supplies and metals. The New York to Los Angeles rate will be \$25.75 per 100 lb, following the directional rate from San Francisco to Chicago the

new 100-lb rate will be \$13.90 compared with a present range of \$12.25 for pharmaceuticals to \$20.95 for nuts, bolts, parts. The Chicago to San Francisco single rate will be \$25.50.

American executives are not concerned about possible revenue losses that might be attributable to bulky commodities which would require large amounts of shipping space and yet would be charged lower rates under the proposed tariff.

Virtually all of American's cargo rates under 150 m. in 1968, an official explained, "are below the rates which would result 75% in 1970. It would be charged for two pounds under a rate which American has used since it entered the air freight business 17 years ago."

Flying Tiger's proposed tariff structure, under development for two years, is designed to "establish a flexible tariff structure, geared to the actual cost of transportation and provide the air freight industry with a competitive rate to break out of its traditional role as a cross, engraver, carrier of goods," a company official stated.

"We're wanting customers who now are shipping materials," one official remarked. "We don't feel that a single rate proposal necessarily will lure these shippers away from surface transport."

Flying Tiger's proposal is based on its acquisition of Continental GL-44 transport aircraft. Encouraging being tail freight which the company claims can cover 65,000-lb payloads at 400 mph for less cost than other air freighters now in use.

Flying Tiger's tariff proposal applies commodities into areas classification based on density at weight per cubic foot with higher density cargo loads subject to lower rates.

Rates are based strictly on an exchange between origin and destination. Only one night haul is included in the classification structure; a rate reduction is included for shipments weighing 5,000 lb or more.

Following are sample rate reductions:

- **Westbound**—Electrical equipment \$9.00 lb from Boston to Los Angeles, from 35.15 cents per pound to 17.6 cents; aircraft engine 9,000 lb from Hartford to Seattle, from 25.5 cents to 15.7 cents; painted material from Chicago to San Francisco from 20.15 cents to 12.7 cents.

- **Eastbound**—Auto parts from Los Angeles to New York, from 25.4 cents to 16.6 cents; scientific instruments from Los Angeles to Chicago, from 19.6 cents to 11.9 cents; railroad, 10,000 lb from Seattle to New York, from 19.5 cents to 13.5 cents.

### Soviet Bush League

Moscow-Aeroflot has been accused of lifting its bulk plane services in Siberia, deterring while contributing to the expansion of pet and subsistence operations from Alaska's bush scene.

Members of the board are one of Lake Rukh complains that the single-rate U.S. 62 is being used for flights that should be back with better, longer range, two-engine, high-wing, pressurized carriers. That is, that a plane such as the Antonov An-12 "Cub" (Little Bee) is built needed, but no one seems to know when that new short haul transport will go into service.

One member of the Rukh board once described the expansion of Siberia bush flying to a Moscow reporter: "When a plane is available, there's no pilot and when there's a pilot, there's no plane. When there are both a plane and pilot, you can't buy a ticket. And when plane, pilot and ticket are all available, the weather's too dirty for flying."

# Air Traffic Control Reserve Proposed

Washington—Next session of the 87th Congress will be asked to set up a Federal Aviation Agency proposal to create a Federal Aviation Service composed of air traffic control personnel who could be returned to military service during times of crisis.

Even bills calling for such a service were introduced and sent to House and Senate aviation subcommittees just before Congress adjourned last week.

FAA Administrator N. E. Halsey, and the Federal Aviation Service (FAS) should remain "entirely civilian" in character but "when deemed necessary in the interest of national defense in the Secretary of Defense," the FAA administrator should be authorized to place "selected members and selected elements" on military status he said.

In addition, the legislation would empower the President to call up the entire Service during war or national emergency, thus placing over military under the Uniform Code of Military Justice. As a result, the government could count upon unopposed air traffic control for both military and

civilian aircraft despite the circumstances.

Recommended by the Project Horne report last month (AV Sept. 11, p. 19), the FAA proposal was set forth in a 55-page study entitled "Special Personnel Problems in the Federal Aviation Agency." Now 21 months earlier, this study was to have been submitted to Congress not later than Jan. 1, 1964, under Section 102(g) of the Federal Aviation Act of 1958.

In a letter of transmittal accompanying the report and attached draft legislation, Halsey disclosed that formation of a Federal Aviation Service had been found "inconsistent with the objectives of the Administration" by the Bureau of the Budget. Department of Defense, Halsey said also in a "mild agreement with the fundamental aspects" of the FAS proposal.

This broad interagency agreement seemed to enter the 86th month passage through Congress. However, Halsey was careful to point out that "actual work" would be required for FAA to receive full responsibility for

all activities, as traffic control functions that encompassing a national goal. At detailed plans are developed and submitted to the executive branch for review, the present bill may be modified by amendments he said.

Although initial congressional reaction to the FAS proposal had not taken shape last week, benefits proposed FAS members by other sections of the FAA report minimized the possibility of serious disapproval. Pointing out that "membership in the FAS would be a condition of employment" for many holding essential FAA positions, and that these employees may be made civilians at the time of the "actual work" without notice," the report recognized that this later assumed civil status was not. It therefore suggested that FAS members be eligible for "veteran" benefits.

This would be granted to Federal Aviation Service personnel "in the same manner and to the same degree" as they are in members of the Armed Forces of the United States. The bill would also require "special" benefits "which FAS service men should receive. At a new statute, the bill allows any FAS member over age 50 to retire from the Service if he has accumulated 20 years of FAS or air traffic control experience.

Among other recommendations included in the report:

- FAA employees should receive "voluntary retirement" to encourage them to leave for experience received during previous changes of duty status.
- Working conditions of all Air Traffic Service personnel should be improved with special emphasis on providing adequate benefits during each day of their 40-hour work week, decreasing retirement levels, installing air conditioning and improving sanitation.
- Controllers should be treated to a fair salary work day. To establish these new work schedules, FAA plans to ask new appropriations from Congress.
- Congress should give certain recognition to that FAA can pay highly educated technical personnel salaries competitive with those offered by private industry. The mobility to attract key experts in an especially acute problem in FAS's research and development programs the agency points out.
- Legislation should be passed to enable FAA to not an upper age limit on others were qualified applicants for air traffic controller positions. This is because the Agency takes approximately 50% of the ATC trainees over age 35, as opposed to only 10% of those below age 35, during their first 15 months of employment.

## SHORTLINES

• **Air Traffic Control Assn.** will have its next annual meeting and Air Traffic Control Exposition Oct. 30 at the Danvers Hotel, Miami Beach. The association urges pilots and system operators to join as workshop sessions to ask solutions to urgent air traffic problems.

• **American Airlines** has begun installation of a \$100,000 computer shop at its Tulsa maintenance base. There, American's technicians run individual engine-driven and turbo compressors used for testing, compression and air conditioning aboard Electra and Boeing 707s. First overhauls are due to begin Nov. 1.

• **Bokan Airways** has reduced fares between Nassau and one of the Outer Islands. Sample reductions: Nassau-Cat Island \$24.00, from \$28; Nassau-San Salvador Island, \$37.00, from \$41.

• **Boeing International Airlines** postpone an larger asset modernization program on return flights. The airline said that increased capacity made modernization unnecessary. The rule was adopted in 1957 to ease the "no show" problem.

• **Central Airlines** reports passenger miles for August at 23,006, a 47% gain over the same month last year.

• **Federal Aviation Agency** has begun a program to simplify FAA safety rules. This involves taking down six or seven thousand pages of regulations into one document questioning about 60 sample rules.

• **Loading firms** are no longer required record aircraft operating over water at night. FAA allows operation to carry firms in optional equipment.

• **Northwest Airlines** will begin through-plane, all-gate service between New York, and Tokyo via Chicago, Seattle, Taiwan, and Anchorage on Oct. 10. Initial service will be one round trip weekly with a Northwest DC7CF or freighter.

• **Yan International Airways** is seeking to extend its route south to Manila, Philippines.

• **Trans World Airlines** will begin direct service from New York to Cairo and New York to Tel Aviv via Boeing 707-323 jet equipment on Oct. 29. Daily flights will be three round trips weekly.

## AIRLINE OBSERVER

• **Sikorski Aircraft** has begun testing aircraft on its S-65 concept, based on its S-65 helicopter-powered flying crane. Armed at the shoulder, the S-65 would carry 40 passengers at a speed of 150 kt. American Airlines, East Coast Airlines and Trans World Airlines were scheduled to install helicopters.

• **Trans World Airlines** Caravelle 10A transports, powered by the General Electric C845-23C turbojet engine, will have nacelle and engine pylon modifications to reduce drag, permitting an increase in burning Mach number to Mach 81. Such changes had started production of one or two Caravelles based on an American Airlines order since March 1961, but dropped later when American bought Boeing 727 turboprop transports instead. These Caravelles will be acquired by TWA and modified to Caravelle 10A configuration as far as possible.

• **Bethel Ocean Airways Corp.** is self-insuring its Bethel Bethel and Douglas DC-3 aircraft in the 1961-1962 fiscal year. Terms offered by underwriters for full insurance, for the entire BOCAC fleet were rejected as too high in the future, but further applications for coverage of the Boeing 737s and the Lockheed L-1049 will be made to more underwriters after and these airplanes are now fully covered by insurers.

• **Federal Aviation Agency** is expected to issue a technical service order (TSO) authorizing airlines to use smaller engine because operating at a frequency of 121.5 mc instead of the heavier, less effective "Cobalt Gold" which operates at 6.6 mc.

• **Boeing** may be developing a new jet transport with all-rotor engines in the Caravelle pattern but with T-tail configuration similar to that designed for the Vietnam VC-10. Photographs of a Conceptual Part description for Composites Guggenheim and TWA, in Moscow show in the background a model of such a transport with Aeroflot markings. Discernible details include a long dorsal fin at rear extending forward to the wing and a smooth wing leading edge. The engine which is much larger than the Caravelle, appears to be mounted in two exceptionally large turbojet or turbofan engines. It is probably a Napier design.

• **Czech** service continued to expand during August in the dominant class of traffic carried by the domestic travelers. During the month, Czech service accounted for 63% of total passenger revenue miles, compared with 54% in August 1960. For the first eight months of 1961, Czech was 54% of total passenger miles against 49% a year ago.

• **Decca** to move the Air Line Pilot Assn. headquarters from the union's new building in Chicago to Washington probably will be made at the next ALPA board of directors meeting. A majority of ALPA's executive committee apparently has convinced union President Clarence Allen that the transfer is advisable in order to support future between ALPA and the Federal Aviation Agency.

• **Lufthansa German Airlines** will begin its entire jet fleet with the DD-101/NC-101 doppler radar navigation system manufactured by Collins Radio Co. Installation and maintenance will be handled by Collins Radio Co., Guelph, of Frankfurt.

• **Nigerian Airways** delivery has completed talks with Aeroflot in Moscow, making the purchase of Soviet built aircraft for use in Nigeria's national flag carrier and the training of Nigerian technical and flight personnel by Russians in the Soviet Union. No decision has been made but the Nigerian delegation has been quoted as being "satisfied" with the results of the discussion.

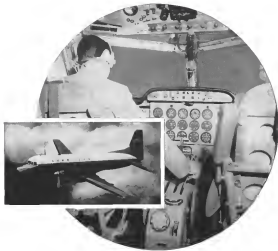
• **Aeroflot** chief Yegor G. Ignatiev has promised that a passenger version of the two-engine Mi-6 helicopter will be "presented for testing" during the last quarter of 1961. He gave no details on seating configuration, although earlier Russian statements said the Mi-6 would carry about 30 passengers.



Convair 880-M Delivered to FAA

Convair 880-M has been delivered to the Federal Aviation Agency for use in testing FAA equipment and for tests which will be part of the agency's overall flight safety program. Transport shown in FAA markings is being air from Laramie Field, San Diego, Calif. Plane was flown recently to Oklahoma City, OK, headquarters for FAA ground school and flight training operations.





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## ALPA's Stand Rejected In Southern Dispute

Washington—Civil Aeronautics Board Chairman William French has rejected Air Line Pilots Ass'n arguments that Southern Airlines engaged in unfair labor practices when it refused to arbitrate issues raised by union pilots who struck the carrier 15 months ago.

Holding that Southern's "impasse" in good faith with ALPA, French specifically stated that the carrier "was well within its legal rights" when it insisted on arbitrating the pilots' claims. French also found that pilots' refusal to work during the prolonged strike.

Similarly, Southern's refusal to consider the striking ALPA pilots at their former temporary levels—thus allowing them higher salaries than pilots hired to break the strike—did not constitute a violation of the Railway Labor Act, the Board concluded.

ALPA President Clarence N. Seven strongly announced that his union would appeal the chairman's decision to CAB. Although Southern "appeared" to bargain in good faith, Seven said, it actually did so in such a way that an agreement could not possibly result. Long established contractual rights supported the union pilots' positions, on retaining their employment security, he contended.

## FAA Moves to Develop Pilot Voice Recorder

Washington—Federal Aviation Agency has selected Hamilton Data Controls to develop a cockpit voice recorder that will preserve pilot conversations on heat, water and airport pool contractors for analysis after an airline accident.

Although price negotiations still were under way last week, a prototype model of the recorder should be delivered to FAA in about four months. It will record and store up to 30 min.

"Adequate safeguards will be designed into the equipment to protect pilots from 'coastal or deliberate tampering,'" FAA reports.

FAA's Aviation Research and Development Service is to test earlier this year, found that special noise filters enabled an open microphone to pick up and clearly record cockpit conversations over over-earhead engine noise. The recorder, which is to incorporate this filter, will weigh not more than 10.5 lb., exclusive of skidbag.

Last month's crash of a Northeast Airlines Lockheed Electra at Chicago, in which the pilot's conversation with the Midway airport control tower was garbled by other transmissions, apparently led to selection of a development firm (AVY Sept. 25, p. 314).



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## Roving Lunar Vehicles—Part I

## Roving Lunar Surface Vehicles Studied

By Barry Miller

Los Angeles—Flying laser vehicles which could crawl above the moon's surface gathering scientific and reconnaissance data and supplying logistic support for manned lunar exploration, among their many functions, are being investigated by aerospace companies in anticipation of impending needs for mobile lunar, and eventually planetary, surface, spacecraft.

Design concepts for a first generation of moving lunar vehicles are now evolving largely stimulated by National Aeronautics and Space Administration's projected Prospector program. Prospector envisions a Saturn booster-derived lunar bus which would be controlled on the moon's surface. The bus might be capable of moving about or even fully disengaging a vehicle (lander) that would communicate the lunar surface, perform scientific experi-

ments, obtain an actual sample of 'bore' and return it to earth. General characteristics of the system—a set specific mission requirements or detailed design characteristics—were given to industry over a year ago. But proposed requests and the subsequent award of possible design studies for Prospector expected during the current calendar year, were delayed several times by NASA and Jet Propulsion Laboratory, manager of NASA's unmanned lunar and planetary missions.

### Surface Tension Interest

The studies of several companies, Boeing North American Aviation and Martin among them, reflect problems that are largely unconnected with the interrupted Prosperity program. Investigations of mobile laser surface inspection by these three firms were supported in the past by the Air Force, which was concerned possibilities of laser obsoles-

turns North America's interest in the practical aspects of lunar surface travel dates from 1968, when it suggested a returner vehicle with a utility payload—as well as a separate mobile vehicle—to NASA's moonbase.

NASA's plans for the Prospector program are undergoing an evaluation and are probably will be revamped to get more effective support for the stepped-up effort to place a man on the moon. A number of original Prospector team members, possibly including the requestant for the young lunar school, now he talked over the Atlas-Centaur-Saturn program (continued stationary lunar vehicle) or to the early phases of the Apollo (manned lunar vehicle), according to the concerns of industry officials.

Whatever the outcome of this re-examination, saving surface checks—both manually controlled initially and later manually controlled—can be expected

to perform a multitude of missions in astronomy, and planned exploitation of the moon and the planets and an infinite effort to gain and hold effective control of space. These functions would include:

- **Blowmolding** wide range of film, bottles, tanks, etc. involves the extrusion of a thermoplastic, extruder-extruding surface and surface composition and determining the distribution of various constituents in the wall of the formed article
- **Electrodeposition** properties: coating, electroplating, electrochromic, electrocatalytic, etc.
- **Coating** different substrates: abrasion, corrosion, adhesion, etc. (inert surface, from different materials, and different sources)
- **Forming** large area of the moon or planetary bodies
- **Joining** and preparing joining sites for joined linear linkers
- **Finishing** a linear chain through depolymerization and reagents control of what they do
- **Acting** on bonding and itself from the moon life, by placing in repeating units and small units at desired points
- **Assuming** much of the burden of carrying physical loads for mass on the

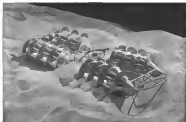
## Industry Interest

As space exploration unfolds, robots mounted on mobile surface vehicles will grow. It needed a high point around month ago—then declared with the delay in the Prospector program and the intense drawing efforts to prepare proposals for manned lunar Apollo vehicle competition.

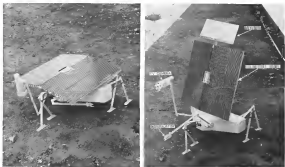
Congressional agencies such as the National Institute for Environmental Health Sciences, the Department of Energy, the Federal Bureau of Investigation, the Department of Defense, the Division of Field Activities, the American Nuclear Society, and the Federal General Dynamics Corporation, General Electric, General Motors, General Atomics, Space General Corp. and Sperry Rand. Others such as Airborne Instruments Laboratory and Hughes Aircraft are closely connected with government and control of sea communications with some vehicles. Most of these organizations have submitted unsolicited proposals to JPL and NASA or accepted those requests of their choice.

Having lunar (radio) designs are controlled by two primary considerations—the use and nature of the devices (booster) system and the lunar environment. Close observation of lunar surface texture, petrological analysis, measurement of physical properties, fields, particles, atmosphere, and determination of body structure, all to be assembled from data of either automated Ranger and Surveyor lunar shots, will find vital data about the moon into the Prospector program.

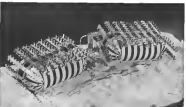
The consensus among those concerned with saving vehicle design is that—with the possible exception of the



**ARCHIMEDIS SCREW** Eversion technique is illustrated in laboratory model above of a vehicle configuration being evaluated for suitability on lunar surface in a test run at State-of-the-Art Laboratory of General Motors Defense Systems Division. Varying speed of individual screws changes vehicle direction. Large doughnut-shaped wheels (belows) which might be desirable locomotion technique for lunar roving vehicles that must traverse irregular terrain, are also under study by General Motors.

[illegible]

**TRACK** that revolves about the body of model vehicle before is designed to provide information on either soft or hard landing. This is one of three basic means of laser reflector vehicle location that General Motors conducts an investigation.



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**MOVING LUNAR** instrument carrier, which would weigh less than a ton and operate from a kilowatt of power obtained from solar cells mounted on two spacecraft axes, could roam moon's surface conducting lunar drilling surveys (left). Radioisotope energy source could provide heat for long-hour nights and for energy conversion system that might provide secondary power. This is one of a bunch of moving vehicle concepts being studied by North American Aviation's Space and Information Systems Division. Arrive's version of Prospector system, as measured by General Electric Mobile and Space Vehicle Department (right) includes solar-powered rover that could negotiate 20-deg slopes, 1-ft boulders and 6-ft crevices on the moon's surface. Rocket launchers, cylindrical structure in center of vehicle could fire small rockets maintaining least heights to earth. High-gain parabolic antenna appearing in lower left on vehicle in foreground helps maintain command and control link with NASA's Deep Space Instrumentation Facility. Supported flat carrier structure is solar panel. Moving vehicle would be subleased on moon by future boosted space truck (left background).

means of locomotion—these are no major technological obstacles, to me, could vehicle design. This is not to suggest there are no major problems in vehicle design and control. There are. Controlling a robot vehicle on the surface of the moon, roughly 25 million miles from the earth poses tough problems. A transmission time delay of three seconds, imposed by the distance, will slow controlled actions of the vehicle. The intense contrast of light and darkness on the moon, caused by the absence of an atmosphere, create problems in recognizing objects. The possibility of easily losing a line-of-sight controlled moving vehicle on the moon is ever-present. Yet there are largely regarded as obstacles that reliable engineering problems.

As for the delivery system, it will restrict both the configuration and moments of inertia of any moving vehicle, engineers at North American point out.

The diameter of the payload nose cone will act maximum limits on the configuration, and the landing dynamics and stability of the delivery system impose limits on moments of inertia.

Although study of moving vehicle systems has centered on problems of lunar vehicle design and control, applicable to varying classes of moving vehicles, these elements of vehicle design are evolving. They are:

• **Lightweight rovers**—These are small vehicles, capable of accomplishing routine mission's missions, which could be loaded on the moon in piggyback vehicles, or less than ten-thousandth before Saturn Prospector or other Apollo spacecraft are ready. Primary value of these lightweight remote-controlled rovers would be to get specific mobile missions accomplished as quickly as possible. As piggyback study is over, a primary payload for pre-launch boosters these must be small.

These lightweight rovers are Space Group's 15-lb mobile vehicle which is designed to be carried in a folded configuration by a support arm on the side of a Centaur-Saturn space craft. General Dynamics/Autonomous has a mobile Centaur-Saturn system rover and a miniature rover suggested for an advanced Atlas-boosted Ranger shot.

Autonomous is also studying two versions of lightweight self-powered crawler, one a 30-lb self-controlled, one a larger vehicle that could be rough landed on the moon at 1,000g, the

other a 200-lb locally commanded, 20 ft range rover.

The three advantages to be gained by these approaches (particularly Centaur-Saturn) may be dissipating slowly with the increased moon month slippage in Centaur's first flight (AW Sept. 1, p. 2).

• **"Prospector" rovers**—These would be heavier or larger mobile vehicles roughly 2,000 to 4,000 lb, would have motor capabilities than lightweight rovers, but would need larger boosters (Saturn), hence presumably could not be put on the moon as soon as lightweight ones. These are not necessarily restricted to Prospector, but the NASA Prospector concept generated their design.

Perhaps typical of these is a small moving instrument carrier, weighing less than 2,000 lb, conceived by North American and intended for use with a Saturn C-1 launch vehicle. This three-wheel craft, would be powered by a

### Percentage of Surface Represented

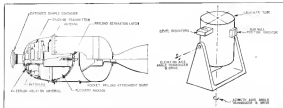
Terrain	Moon			New Moon		
	V	N	D	V	N	D
Very smooth	15	15	15	5	5	5
Smooth	30	30	30	10	10	10
Wavy	30	30	30	10	10	10
Very rough	30	30	30	10	10	10
Extremely rough	10	10	10	10	10	10

CHART indicates probable percentage of very smooth through extremely rough terrain that would be encountered in lunar and other areas on moon's surface according to three hypotheses of terrain: relative origin (V), meteoritic impact origin (N), and dust (D). Smooth rough boundary values to lunar smooth and rough scheme shown in chart, p. 68. Names of terrain will be used consistent of vehicle design.



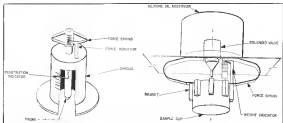
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10,000 psi**

An easy "push" to connect and "pull" to disconnect is all it takes to operate the new Deutsch high-pressure fluid and gas coupling. No twisting or tricky lock movements are necessary. Here then is an effective design that can be specified for a



However, power applied by solar panels during the launch day would derive a small amount of power for limited use during hours when ground-to-orbit energy transfer system. Similarly, General Electric's Mission and Space Vehicle Department envisions a rover or robotic laboratory, solar powered and used in two pairs of wheels within a radius of 250 m from the landing site. Space Road has designed a 28.5 kg, 14 ft wide, 1.08 ft tall rover, chocky driven by two large spinners that rotate in opposite directions to give the rover a 100 ft diameter turn radius while. All of these vehicle concepts incorporate a rocket launcher containing a return vehicle that could carry lunar samples back to earth.

These designs are on display at Prospector. Actually, some Prospector concepts already include this flexibility, and it can be dictated by the philosophy that all self-contained equipment should be designed to allow men when they are called back to the equipment site at a Sperry Rand's nuclear group, guided by the consensus: designed to move large enough and with sufficient controls and electronics for use by the Apollo team when it arrives.





## Inventory Management Simulator program at... Clark Equipment...improves customerservice...with less inventory



■ **High-capacity memory** Two IBM 303 Data Processing Systems with RAMAC have tracks of 75,000 replacement and repair parts in Clark's Chicago parts warehouse. ■ **The computer has the books.** As soon as an order is entered at the warehouse, an operator logs the order into the system near the loading platform. Items end from the computer where various items go. ■ **Customer service link.** Using this remote storage device in the sales department, the operator gets information from the computer while the customer is on the phone.

Clark Equipment Company has prepared a computer program called an Inventory Management Simulator. The program allows Clark management to study the possible effects of decisions on future customer service and future warehouse profitability. When management gets the computer's report, it is in a position to make new rules for the operation of its parts warehouse.

Here's what's happened since Clark put the new program into operation: ...improved customer service...practically eliminated back-order problem...reduced the gateway time for incoming material by more than 50 per cent...reduced emergency order shipping time by 50 per cent...enabled a physical inventory to be taken without any interruption of service to customers.

**Availability highest ever.** Inventory management is a complex job at Clark, its Chicago warehouse is one of the largest and largest in the country. Before the Simulator program was developed, the warehouse carried an inventory of 35,000 individual replacement and repair parts. Use of the program helped transfer the investment in inventory to those parts most frequently called for, giving high availability with less investment.

**Management Operating System.\*** Clark installed two IBM 305 Data Processing Systems with RAMAC. These computers store, update, and offer on an instant's notice information on almost every aspect of the warehouse operation, including complete information on every one of the 35,000 items maintained in stock.

Now, Clark is assured of maintaining just the

right level of stock for each item. The program's formula, developed from the Inventory Management Simulator, even recommends how large a purchase order should be placed for each item and where it should be placed.

If you have an inventory problem, why not consider a simulation program? You don't have to have your own computer. We can supply you with an Inventory Management Simulator—put our work time on a computer. Result...improve the profitability of your warehouse operation.

IBM Management Operating System uses IBM's proprietary data structure built on the time and data action methodology. It also provides the best management of special programs... from one system to many... on the big problems and the best results showing. As a result, it gives higher control of all business operations... and helps you win.

**IBM**  
DATA PROCESSING







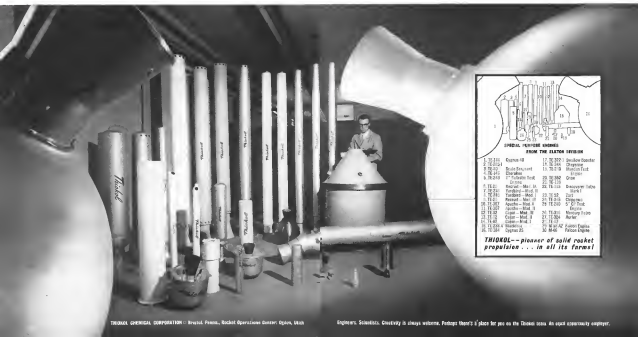
**SOLID RELIABILITY  
FOR  
SPACE RESEARCH**

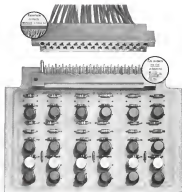
In 1947—Thiokol, working in cooperation with JPL, helped develop techniques for case bonding that made possible today's solid fueled giants. Since that time... from the RV-A-10 engine which proved feasibility of scale-up and the Falcon which introduced mass production to the rocket industry, to the huge booster for Minuteman and the high thrust power of Nike Zeus... Thiokol history is one of innovations marking progress in rocket propulsion. □ Thiokol retro-rockets contributed in large measure to the

success of the Discoverer Program and the recovery of the Mercury capsule. □ Pioneer in development of solid-fueled rockets of many performance characteristics for many systems (spherical engines to yield high mass ratios, special units for ramjet control and gas generators), the Corporation has built a record which—in terms of reliable engine performance, timely delivery and economical operation—reflects the Thiokol capability required to meet present national demands for leadership in space and defense.

**Thiokol<sup>®</sup>**  
**CHEMICAL CORPORATION**  
**FIRST IN ROCKET PROPULSION**

# BENCHMARKS in the science of rocket propulsion





## NO TWIST, TURN OR OFF-CENTER SEATING OF CONTACTS IN THIS CONNECTOR

The AMP's cert® Blade Connector is staked down the staked pin position on the board gives you positive alignment and perfect contact at all times! No board warpage either! The built-in spring action in a registering member keeps the board straight level and true regardless of environmental conditions and repeated insertion and extraction. These are just two of the answers that AMP's cert Blade Connectors have for maximum reliability, lowest installed costs and trouble-free performance. There are many more, for instance:

- No need for but crimped contacts with AMP's stamp type, snap-in design
- guaranteed individual contact forces
- large contact areas reduce connector pressures, avoid hard wear on plating and increase contact life
- raised barrier sections and large contact cavities prevent moisture entrapment
- recessed cavity construction eliminates need for shimming
- rigid metal guide pins assure perfect connector mating during insertion

Complete details will be sent on request.

Patent of AMP Incorporated

# AMP INCORPORATED

GENERAL OFFICES: HARRISBURG, PENNSYLVANIA

AMP products are represented in most U.S. and foreign countries by sales offices in: Australia • Canada • Europe • France • Germany • Italy • Japan • Mexico • South America

to operate during at least two of these 14 day stretches.

A stress tolerance subprogram proposed for Space General's next model.

• **Powerful safe launch test launch**—

• **Enable estimation** to be made of weight, height and depth of loads from test launch objects.

• **Provide visual observation** of experiment while they are in progress.

• **Survey and map the terrain**.

• **Guide use of manipulator in making repairs**.

• **Transmit data** regarding wide load width.

A slow vehicle speed (approximately 2 or 3 mph), low TV frame rate (1 picture per 1 sec) and the nearly 1 sec transmission delay add up to one picture for every 100 ft of vehicle motion.

The map goes, reflect to properly guide the vehicle.

A command and control subprogram will regulate steering, stoppage, maneuver, speed, manipulator control, television operation, recording of experiments and other physical operations.

A low power telemetry transmitter will return to the earth data such as temperature, pressure, vibration, etc., which don't require wide bandwidth or are not suitable for television presentation.

The solar cell panel power system will be connected with solid state electronic battery packs to which the solar cells deliver their outputs during portions of the lunar day when vehicle is not on a line of sight with the control center. Batteries store energy for a later use and in supplying peak requirements. A power distribution and control panel will regulate power to each battery assembly and to the computer, safe for varied outputs under widely varying temperature conditions on the moon.

Many of the techniques of sampling power now used in space vehicles as well as techniques expected to mature in the future will be applicable to roving lunar vehicles. Lunar environment.

North American engineers say they require modifying but reaction without a power device under development. Power needs may run from a kilowatt or less in small remote-controlled vehicles to over 10 kw for large manned vehicles.

Individual power systems stored by North American include:

• **Solar energy conversion**—These will have attention to base design, power, which may prove satisfactory, for moon-controlled, autonomous operation of roving vehicles during long lunar nights may be desired, and with high power requirements of large vehicles, solar conversion might not be satisfactory for these missions.

• **Internal combustion engines and fuel cells**—Conversion during long expendable missions may be useful for large manned surface roving vehicles provided fuel can be replenished.

A hydrogen-oxygen fuel cell would require 2,500 lb of fuel and equipment to produce 10 hp for seven earth days. With an average vehicle speed of 2 mph, this would provide an operating radius of 100 mi.

• **Nuclear power**—While small nuclear supplies offer power as an unexpensive base, shielding mass and equipment base reduction and the extra against contamination add problems.

Shielding for men and equipment may not be excessive for larger roving vehicles. Three hundred to 400 lb should be adequate to shield most electronic equipment when the 3 kw Stargate 2 system is employed. Shielding for men might run 1,000 lb depending on the vehicle configuration.

The 30 kw Stargate 3, North American points out, often 10 times the power with only a six-fold increase in weight over the 3 kw version.

Roving lunar vehicle will be based on many current experiments ranging from measurement of physical and electromagnetic properties to tests of the effects of lunar environment on biological systems. The larger run of three roving vehicle concepts.

Study at Ames Research Co. expected to be capable of carrying ecological sub-

systems. Many companies describe their roving vehicle libraries as closed libraries.

Typical experiments SpecGen will be carrying out in roving vehicle on a driving force sensor in penetration depth measuring device and a device for measuring both density and friction of lunar material. The company says its vehicle can obtain such useful information from vehicle parameters automatically even though it carries only 16 ft of instruments.

The driving force in penetration depth device is similar to a Pyrojet penetrometer. A cylindrical thread with flat circular flange rests lightly on the lunar surface. The manipulator presses on a force spring at the top of the device, pressing a probe, guided by the top of the thread, into the surface.

Compression of the spring indicates force required to drive the probe. Depth of penetration of the probe into the surface can be read by the TV camera from a scale showing relative displacement of probe and thread.

A second device measures density and soil friction (shear) values between particles, such as volcanic basalt grains of sand. The manipulator brings up a sample of lunar surface in a cup, scrapes the excess material from the top by moving its top under a horizontal member of the vehicle.

Magnets around the top's lip hold it against the bottom of two lead strips.



Gen. Flickinger Receives DSM

Gen. Don D. Flickinger, who retired Aug. 11 as assistant for Manpower to the commander of Air Force Systems Command after more than 27 years' service, received the Distinguished Service Medal from AFMPC Commander Gen. Bernard A. Schriever for "extraordinary meritorious service" in connection of the European office of the Air Research and Development Command and headquarters assistant to Schriever in the 1950-1960 period. "Early in this period," the citation said, "Gen. Flickinger became the first to mention space flight as the immediate future." Gen. Flickinger has become a headquarters consultant in Washington, D. C.

## SONIC VIBRATION PROBLEMS ON DC-8 SOLVED BY BLIND BOLTS



Above photo shows partially electric/hydraulic Power Unit (3000 psi max., 100 v. source) including hand held hose to over 1200 Hand Bolts in each Ejector and Street Shovel. An hydraulic Power Unit may safely used in Right hand manure for repair on fuelled aircraft Hand maintenance tools are also available.



Blind Bolts were finally selected by Douglas DC-8 engineers for use in the Sound Suppressors. Exhaustive tests of various blind fasteners determined that Blind Bolts in temperature areas could best resist centrifugal sound pressure levels reaching 150 decibels.

In this unusual application, the remarkable ability of the Blind Bolt to resist some vibrations stems from several of its inherent design features — the *locking technique*, containing the oval lock of the Expander to grip the flared of the Core Bolt and the wedge lock between the Expander and Sleeve and the *lock filling* action, resulting from the expansion of the Sleeve shell during the installation pull-up of the Expander into the Sleeve and, finally, the *excellent fatigue resistance*, gained from the high tensile profile imposed by the Core Bolt and from the cushioning effect of concrete's inner materials.

Because the consistent of expansion must remain the same to prevent loss of injector preload, the compatibility of structural materials at high temperatures is essential. Inside the stainless steel Ejector where exhaust gases reach 900°F., A-316 stainless steel Blind Bolts are used. On the outside where structural temperatures reach 300°F., Type 432 stainless steel Blind Bolts are used.

From the shop viewpoint, Blind Bolts are installed rapidly and quietly. Hole preparation is simple, no reaming is required. Only Blind Bolts offer a choice of gun driving tools designed for repair or modifications in difficult or tightly congested structural areas.

**If space restriction is your fastest problem...consider Blind Bolts.**

Write for brochure.

**hi-shear** CORPORATION

资料来源：根据《中国统计年鉴》、《中国人口统计年鉴》、《中国固定资产投资统计年鉴》、《中国劳动统计年鉴》整理。



The manipulator is released and weight determined. Since the cup is full, the volume is known. Then silicone oil is poured into the cup and volume of oil determined. From this density and  $\rho_{\text{lead}}$  can be determined.

An important function, related to moving home vehicles, will be the task of obtaining and then returning a loaner sample to earth. Several concepts propose this as an integral part of the moving vehicle duties. Moving vehicles as mentioned by General Electric, Sperry Rand and North American, for example, would contain single roller launchers and single small individual rockets capable of sending small payloads back to earth.

Space-General has proposed an IPI, a special lightweight cockpit system which could be attached to the Service spacecraft and weigh 130 lb., less than the instrument payload capacity of Service. The market is designed to return laser samples obtained in it by the drill use of Service.

The ester system would consist of a silica rodlet, fired as compared from Goldstone, a burner, apparatus for measuring and sucking the lunar sample and a programmer and telemetry system.

The atom rocket would be a single-stage solid propellant vehicle weighing slightly over 68 lb. Its 45-lb motor would boost a 19-lb reentry payload out onto an orbital velocity of 9,000

polyurethane nitrocellulose propellant containing a small amount of aluminum. The motor would have a mass fraction of 0.925 and could produce a specific impulse of 296 sec (at design chamber pressure of 300 psi) with a 45:1 sec ratio ballistically neutral.

The payload is divided into three chambers. One air-facing chamber will accept the basic sample; a second will heat sensors and such at room-temperature aluminum power; third replicates helium/neon balloons, and a lighter-than-air corner reflector balloon. The main chamber will contain power supply, signal tracking and much more; transmitters, balloons inflation gas storage container and other electronic and electrochemicals too.

The rocket is carried to the room within a trolley attached to Survivor. The launching sequence as well as the measuring, transport and loading of the sample into the nose cone chamber are controlled by a programmer, command receiver and telemetry transmitter all weighing about 5 lb. and consuming about 6 watts.

Rocket launching will be controlled by Collicious

Other interesting features of roving looms: vehicles under study by industry include:

- **Scout Bands**—The 2000-B series

vehicle is designed to evaluate prospective Apollo landing sites, to perform terrain sampling and analysis and to be used in follow-up Apollo crew. It is powered by a combination of solar cells and batteries, requires 1,200 watts, can travel at 2.5 mph, and is guided by earth-based operations through TV camera. It would carry a sample drilling system and would carry an air chamber among its laboratory equipment.

• **Aeromastronic**—Three vehicles under study at Aeromastronic differ basically in the manner of intended control. The 50-lb crawler, which has calculated life of 10 hr and requires 280 man-hr of

energy, would have self-contained control systems. A large, 700-lb. crawler could be commanaded locally, possibly from a mother craft, such as a Sparrow. Its reported lifetime is 100 hr and 10 kilometers/hr of energy are required. Both of these lightweight crawlers are battery operated. The largest of the three Aerostronautic vehicles, a 1,000-lb. craft, would be controlled from the earth, powered by what the aerospace designer, as a representative

Food development have an expected life of 500 hr and an average operating time of 1,000 kilowatts. Its range would be 100 m.

- **General Electric**—This company's work at Mobile 1 laboratory, designed as part of a Prosemer scheme, will be

capable of negotiating slopes of 20 deg., 1-ft. boulders and 6-ft. crevices. It can carry several interchangeable payloads. Special radiation materials were devised that will enable it to operate in temperature extremes from +150C to -115C.

This is the first portion of a two-part article on rating loan vehicles. The second part, dealing with rating loan vehicle control and communication, will appear in the next issue of *American Banker*.

## Satellite Propulsion Pulse Rocket Tested

Continues operation for 46 yrs has been announced for a 250-hp thrust radiation-cooled bipropellant pulse rocket tested by the Marquardt Corp.

Applicable to current satellite propulsion requirements, this type of rocket engine has reportedly demonstrated a space specific impulse of 310 sec., using a fuel of hydrazine and nitrogen tetroxide. Damage to the engine at the end of the test run was negligible. Maximum test

Pulse frequencies up to 100 pulses per sec. in ranges from 0.2 to 100 Hz direct have been demonstrated with effective pulse widths as low as .001 sec. Combined response and delay times of .005 sec. now are available and will be reduced to .001.

## PROBLEMATICAL RECREATIONS 86



How many planes are in the following infinite series where the digits are arranged in descending order? 9, 99, 999, 9999, ...

Of prime importance to our Data Systems Division are systems engineers who can integrate developmental sub-systems into a smoothly functioning digital technical data system. Tell us about yourself if you're in Chicago at the 17th Annual National Electronics Conference, Oct. 5-11, by calling Bob Baker at ANA/over 5-1131. If you don't get to attend, write: Mr. Baker, LSC.

ANSWER TO LAST WEEK'S PROBLEM: It should take the hench 32  $\frac{11}{11}$  hour to come together, not 65 minutes or  $\frac{13}{11}$  hour as it actually does. Therefore, Dr. Reed's watch runs too fast by a factor of  $(32/11) - (13/11) = \frac{19}{11}$ . In one hour it gains 90  $[(164/142) - 1]$  or 63/142 minutes.

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Data Systems Division  
Crescent Park, California





Package design of Weld-Pak® module

Welding interconnections on Weld-Pak® module

Raytheon Weld-Pak® logic slice

## Raytheon "Know-How" Supports M.I.T.'s Advanced Polaris Development

Raytheon is presently devoting part of its unique industrial support talents and facilities to system design engineering and manufacture of electronics for the Advanced Polaris Guidance System. For this program Raytheon is under technical direction of Massachusetts Institute of Technology's Instrumentation Laboratory.

For other university or government laboratories, major missile, space and weapons systems contractors, Raytheon capabilities are ideally suited to basic product design, prototype and production manufac-

ture, flight and environment testing, and field support of operational equipment.

Reinforcing these capabilities is Raytheon experience as prime contractor-systems manager on two major missile programs — U. S. Army's HAWK, U. S. Navy's SPARROW III. Related achievements include Raytheon's famed Weld-Pak® all welded, high density wiring and digital components, hydraulic actuating valves of varying dimensions, electrical power units of extremely favorable power-to-weight ratios, weapons systems radomes, missile guidance miniature rate gyro.

For full information on how Raytheon can lend industrial support to your organization's program, mail coupon.



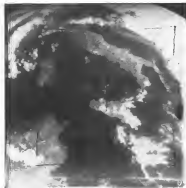
**RAYTHEON COMPANY**  
AERO/WEAPONS DIVISION

For the Polaris Advanced Guidance System, Raytheon applies PERT-oriented program management techniques throughout, plus the following industrial support functions:

- Circuit Design Assistance
- High Density Packaging
- Instrument Calibration
- Reliability Tests
- Test Equipment Design
- Documentation
- Rapid Engineering Model Fabrication



**RAYTHEON COMPANY**  
AERO/WEAPONS DIVISION



**CLAR OUTLINE** of the Helen Frances, the third sister of Sudy and Sushie, and the Tondra mother a son in that photograph made Sept. 11 by Tosa III on an 17160 gun. This picture was transmitted to the First Maps and shot video.

even perched out of focus at launch. The satellite returned 15,334 photographs during its lifetime, which began Nov. 21, 1968 and ended Sept. 14. About 75% of the pictures were useful. It was launched by a Delta vehicle.

•Tosa III launched July 12, and by mid-September had returned approximately 18,000 useful pictures. With the exception of Tosa III, which only

displayed a cloud cover of Sudy and Sushie, the operational information. The primary analysis has indicated that sensors can demonstrate the net loading on the earth's atmosphere, and compare regional variations with seasonal weather patterns.

•Tosa III contains three types of infrared radiometer.

•Scanning, which measures infrared heat energy by sensors located at an angle to the satellite's path.

•Non-scanning, measuring total radiation in the vicinity of the earth and radiation emitted by the sun.

•Cross-directional, measuring total solar radiation and long- and short-wave radiation from the earth.

The direction, as designed to measure the earth's albedo-radiant energy—and to determine the amount of cloud cover at night when the satellite cannot be operated. They should help monitor the temperatures of cloud tops, determine cloud depth and the surface temperature over cloud-free areas.

Second Tosa satellite operations began when the period is repeated from the third stage of the Delta launch vehicle. Third Delta stage is again stabilized at 135 rpm. About 10 minutes after separation, a timer releases a

"to go" de spins rotation—slightly less opposite ends of the package—weighs down the spin rate to about 12 rpm.

To remain stable in orbit, Titan must attain a spin rate of at least 9 rpm. When the spin slows below 10 rpm, a set of free rotors is spun on ground command. Titan 21 has five pairs of spin rotors. Ground stations at Ft. Monmouth, N. J. and the Nicholas Island program the rotors, command to function through an electronic clock mechanism. Operating like an alarm clock, the timing system is set when the satellite passes over the ground station. The rotors are then spun around. The rotors are then spun back over the ground station, the type is used again.

#### Direct Method

Direct picture taking is used when the satellite is within range of Wallops Island or Fort Meigs by operating cameras on ground command, stopping the spin rate to halt.

All ground station cloud cover pictures are displayed on photographs. Low-angle and both photographs and infrared data are stored on magnetic tape for permanent recording. IR tapes are processed at NASA's Goddard Space Flight Center and copies of cloud cover pictures are sent to the Naval Photographic Interpretation Center here for developing and processing.

Metereologists look at Wallops and Meigs for immediate action for operational use.

#### Tiros' Achievements

Washington-Tier 1 photographed a storm over the central U. S. for the day it was launched, and the Tiros series of weather satellites has made a number of weather forecasts in its 10-month history. Among the notable achievements are:

- Tiros 1 photographed a dense cloud shield spawned by thunder in Oklahoma, Texas, and began a photographic series of cloud cover which are providing a means of studying specific storm types. This satellite also located a severe tropical storm in an Air Force refueling area near Bermuda, and then spotted a close view so that the rotating operation could be conducted safely.
- Tiros 2 spotted a cold front moving toward New Zealand, which passed over a long bay there during the New Year holiday season.
- Tiros III photographed all tropical storms in the Pacific the 1951 hurricane season, and discovered Hurricane Esther.

Metereologists hesitate to make the forecasts in order of significance, since photographs are still under research and analysis.

RCA developed a magnetic coil system to set the first loop on Tiros II, to control the attitude of the satellite. The attitude line is wrapped with a coil of 250 turns of wire which extend into the satellite's magnetic field and after the satellite is in orbit is powered on ground command. Tiros II was altered by the earth's magnetic forces, which carried the satellite to fly gradually away from a position vertical to the earth's surface.

Second-generation Nimbus, which is actually will be the first operational weather satellite system, and the main of the procedures and systems being tested in Tiros. A major difference is that Nimbus will be earth-orbiting at all times and will be a polar orbit. Nimbus will weigh about 600 lb. and will be launched from Pacific Missile Range by a Thor Apollo vehicle.

The instrument complement in Nimbus are being designed for most applications than those in the Tiros series. Video camera resolution will be finer, and active infrared IR returns will be used. First-generation Tiros will have high-resolution electronic tape can can which if successful, will be the present photographs and in subsequent Nimbus satellites.

#### Aeros' Problems

First-generation weather satellite in the Tiros series a problem which has not yet been fully defined. Under contract plans, first flight, 6-21 to be launched on a two-stage earth orbit at 21,000 mi. altitude, so that it will cover the area, portion of the earth at all times. Major problems in this orbit will be attitude and orbit correction, and a reliable camera system.

Panel on Operational Meteorological Satellites (POMIS) has approved a system plan for an operational system which would include participation of foreign nations in high global coverage. Fully operational returns would begin in 1964 with an annual expenditure of about \$60 million, of which \$48.2 million would be used for the development and four Air Force launch vehicles.

Continued and data acquisition stations (communications nets and networks) are to be funded in Fiscal 1962 and 1963 budgets, at a total cost of about \$27 million.

Operational returns include a continuous station in Fairbanks, Alaska, another on the U. S. East Coast and a third in Europe. Wallops Island is also in plans, would be used for the first Coast station, and a Scandinavian site is planned in Europe. Continued and data acquisition stations would be selected to cover all areas.

The POMIS report recommends that the weather bureau be given responsibility for the meteorological satellite system. It concludes that continuous

weather coverage is now where the group of any station on Tiros II, to control the attitude of the satellite. The attitude line is wrapped with a coil of 250 turns of wire which extend into the satellite's magnetic field and after the satellite is in orbit is powered on ground command. Tiros II was altered by the earth's magnetic forces, which carried the satellite to fly gradually away from a position vertical to the earth's surface.

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#### Flight Schedule

Flight schedule for the operational system has been divided into three phases:

- Calendar 1962-63 one Nimbus in orbit at the time which will be the launch of five Nimbus satellites, each with a six-month lifetime, and two backup payloads.
- Calendar 1964-65 one Nimbus in orbit at the time, and a second Nimbus in orbit at the time, each with a six-month lifetime, and two backup payloads.
- Calendar 1966 and beyond two Nimbus in orbit continuously, and an Aeros in orbit at the time, with an annual launch of three Nimbus satellites and two Aeros satellites.

Participating in the panel study, which was made under sponsorship of the National Coordinating Committee for Aeronautics Meteorology, were representatives of Air Force, Navy, Army, Weather Bureau, Federal Aviation Administration and NASA.

## Test Rig Measures Ion Propulsion Thrust

Historical propulsion test rig measures thrust of ion thrusters used in space exploration. The test rig is designed to measure the thrust of ion thrusters used in space exploration. The test rig is designed to measure the thrust of ion thrusters used in space exploration.

The test rig is designed to measure the thrust of ion thrusters used in space exploration. The test rig is designed to measure the thrust of ion thrusters used in space exploration. The test rig is designed to measure the thrust of ion thrusters used in space exploration.

The test rig is designed to measure the thrust of ion thrusters used in space exploration. The test rig is designed to measure the thrust of ion thrusters used in space exploration. The test rig is designed to measure the thrust of ion thrusters used in space exploration.

# AVIONICS

## Two-Axis Gyroscope Uses Spinning Liquid

By Philip J. Kline

Unsettled design of two-axis gyroscopes which uses a spinning liquid instead of the conventional spinning metal rotors, making the device an extremely sensitive means for angular rate and displacement, has been developed by Sperry Gyroscope Co., Great Neck, N. Y. Sperry has built models of the new liquid gyroscope which can measure angular rates as low as several hundredths of a degree per hour and which can detect angular displacements as small as 1/100 sec. of arc, according to W. G. Wing, director of the company's inertial instruments engineering.

The use of a spinning liquid not only gives the device unusual operating characteristics, but also gives simplicity in design and fabrication. As a result, Sperry expects that the new SYG-2000 gyro will sell for about \$7,000 in quantity production.

Company expects a building a pilot quantity of the SYG-2000 gyro for use in an industrial guidance project. Continued development of the fluid sphere gyro is being sponsored by the Air Force Aeronautical Systems Division.

Current models of the new gyro measure 15 in. in diameter by 64 in. long and weigh 5 lb. Random drift is quoted at 0.1 deg/hr and insensitive drift at 0.01 deg/hr.

The gyro can be designed to operate at any temperature between -100° and 200° and can be stored at temperatures over an eight month range. Warm-up time is eight minutes maximum from storage temperature to operating rate.

Drive motor power consumption is 10 watts.

#### Operating Principles

The high-density, low viscosity fluorocarbon liquid which serves as the gyro rotor is set spinning by a motor-driven cylindrical resonator with specially-shaped cavity which is filled with the liquid. The spinning spherical cavity quickly brings the liquid up to its resonant speed. In some experimental models, spin rates of 12,000 rpm. have been used.

If the gyro case and the spinning spherical rotor are displaced through a small angle, corresponding to a change in attitude of a flight vehicle, the spinning fluid satellite will continue to spin, and this rotation is sensed. But, then fluid rotor force will cause the spinning fluid to precess into alignment

with the new attitude of the rotating spherical cavity.

The time constant for this design system depends upon several design parameters, some of which can be controlled. In present models, the time constant can be designed for any value from a few milliseconds to about one second. Several techniques now under investigation may increase the time constant, perhaps to several hours.

The coupling between the resonator cavity and the spinning liquid is one of the unusual characteristics of the new gyro. For a brief instant, if perturbed in the direction of a new angular displacement gyro, but lacks the long-term spatial stability of a conventional gyro. However, when used with external reference, the fluid sphere gyro can be used for inertial platform stabilization, according to Wing.

#### Important Differences

The coupling is similar to that found in gyroscopes with spinning rotors.

When the spin axis of the fluid sphere corresponds to the rotation axis of the carrier, there is a constant pressure on the transducer which produces no output signal. When the carrier is displaced

radially, centered in conventional gyroscopes, the gyro, according to Wing.

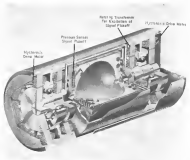
#### Signal Pickoff

Like the electrostatic transducer gyro and the cryogenic gyro, the fluid sphere device cannot employ a conventional signal pickoff to measure slow displacement since there is no mechanical connection between it and the external environment.

To sense displacement of the spinning liquid with respect to the rotating cavity, Sperry has conventionally sensitive pressure transducers which functionally resemble a capacitance-type transducer. They are excited from an external 10-Mc/sec. source which is inductively coupled to the rotating member.

Four of these pressure sensors are located in pairs on the rotating member. Each is situated at an angle of 45 deg with respect to the spin axis and are displaced 90 deg from one another around the periphery.

When the spin axis of the fluid sphere corresponds to the rotation axis of the carrier, there is a constant pressure on the transducer which produces no output signal. When the carrier is displaced



CUTAWAY of only model of new gyroscope shows rotating cavity which causes fluid to spin. Sperry claims gyroscope uses a spinning liquid instead of conventional spinning metal sphere. Use of spinning liquid simplifies gyro design and fabrication.

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with respect to the spinning fluid, a positive mechanism in the fluid spin rate occurs across the appropriate rate of transducers. The response of the ac signal is proportional to the amplitude of displacement and its relative phase indicates the direction of displacement.

By using a pair of transducers for each sphere spin, and notably, connecting their output windings, the sensors are largely insulated by external vibration of the spin rate which otherwise would induce spurious output signals.

## Advantages Cited

The use of a spinning fluid in the rotating mass gives the new Sphery gyro a number of unusual features and potential advantages, according to Wang.

These include the following:

- **Mass balance:** One of the basic requirements for any gyro is that the center of mass of its spinning rotor coincide within very close limits to the center of support. While this requires precision machining and extreme care in assembling a conventional gyro, mass balance is an inherent characteristic of the fluid sphere gyro. If the fluid has sufficiently density, its center of gravity automatically centers on the center of support, even when the rotating cavity which induces the fluid spin is tilted considerably out of round. The fluid sphere gyro does require modest attention to temperature gradients since small temperature gradients will create a variation in density, but this is a relatively easy problem to handle, according to Wang.

- **Isocentricity:** If a gyro is to maintain low drift rates in the presence of external accelerations, it must either use an extremely rigid rotor or one that is equally compliant in all directions to avoid that the center of gravity remains aligned with the center of support at that air displacement occurs in the direction of the acceleration vector so as to not produce spurious torques. These conditions are met by the inherent characteristics of the fluid sphere gyro, according to Wang. The only application drift results from the compressibility of the fluid in the cavity. Sphery calculations indicate this amounts to only 0.041 deg/hr/g.

- **Reliability:** The fluid sphere gyro requires only about one-half as many parts as a conventional sphere gyro, Sphery says. Gyro performance is virtually independent of dust or other non-contaminants which can cause malfunctions and/or short operating life in certain types of conventional gyros.

Because the drive motor is external to the spinning fluid mass, any shift in the mass of the drive motor windings during extended use does not introduce



**NEW FLUID** sphere gyroscope, which uses spinning mass of liquid instead of conventional metal rotor, can be used in an extremely sensitive rate or displacement type gyro. Gyro can only hold the number of parts of a conventional gyro and should be less difficult and less costly to produce.

any rotor unbalance in the spinning fluid. Similarly, rugged nonprecision type housings can be used for the rotating cavity element since any changes in bearing balance with wear does not affect spinning fluid mass balance.

Under Aeronautical Systems Division sponsorship, Sphery is conducting a feasibility study of the application of the new type gyro in a stabilized platform, using external integration.

Wang is confident that Sphery can produce fluid sphere gyros with random drift rates of only 0.1 deg/hr/g, or about one-fifth the drift of early experimental models.

Because such a gyro is expected to have so much unbalance error, company engineers predict that its performance will be equivalent to a conventional Hughes gyro with a random drift rate of 0.01 deg/hr and a mass unbalance drift of 0.1 deg/hr/g when applied to high-rate, high thrust flight systems, such as that of the Nike-Aerostar Avastar X-15 nuclear research plane.



**SCHEMATIC** shows the independent type transducer used to measure change in pressure that occurs when gyro is displaced with respect to spinning fluid sphere.



## A SERGEANT MISSILE HAS JUST BEEN LAUNCHED!

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## Acoustic Amplifier Has Wide Application

Fundamentally not a type of transducer device, called a traveling wave acoustic amplifier, which can be the first of a whole family of acoustics capable of operating at high frequencies, has been discovered by scientists at Bell Telephone Laboratories.

The newly discovered principle involves the amplification of ultrasonic waves in a piezoelectric semiconductor crystal through the interaction of the sound waves with electrons drifting in the crystal.

Results of experiments to date suggest that the new principle can be used in a variety of devices, including a traveling wave amplifier, oscillators, isolators, and a delay line which enhances the signal rather than attenuating it. Using a crystal of cadmium sulfide resonating upon ultrasonic lengths, BTL scientists report that they have achieved gains of 38 db for a 45-mc signal and gains of 15 db with a 15-mc signal.

The new principle, first proposed by BTL's Dr. D. L. White, is an outgrowth of the discovery last year of the piezoelectric properties of certain types of semiconductors, such as cadmium sulfide and zinc oxide. Subsequent experiments revealed that ultrasonic waves are attenuated in such crystals when they are exposed to light.

More recent experiments showed that amplification can be obtained if a cadmium sulfide crystal is exposed to light and a direct current electric field is applied to the crystal in the direction in which ultrasonic waves are propagating through the crystal.

The amount of amplification obtained depends upon the magnitude of the applied voltage which produces the d.c. field and the conductivity of the semiconductor crystal, which in turn depends upon the strength of the illumination.

The explanation for the phenomenon observed in BTL crystals is as follows: When a sound wave travels through a piezoelectric material, it produces a longitudinal electric field which travels along with the wave. If the material also is a semiconductor, the electric field means currents to flow in the material.

Because, the piezo-electric field is periodic, the electrons will be pushed to the front of the ultrasonic wave, interacting with the piezo-electric field. This in turn results in the material itself, causing a corresponding change in the velocity and amplitude of the sound wave traveling through the material.

If a d.c. electric field is superimposed on the material so as to cause the

## Collins Offers PERT

**PERT** (Program Evaluation Review Technique) scheduling and control program for an IBM 7070 computer, developed by Collins Radio Co. for its own use, is being offered for sale to other potential users. The PERT program package includes a description of the computer program, a program deck, flow charts, logic diagrams and a description of system operation. The package can be obtained by writing to Charles R. Tilton, Collins Radio Co., Communications and Data Systems Division, Cedar Rapids, Iowa. Company reports that it is now offering PERT management techniques to nearly 70 military and commercial programs.

hundred cycles to drift in the direction of the wave propagation at super-sonic speed, the ultrasonic waves will be amplified in much the same way that electromagnetic waves are amplified in a traveling wave tube. Dr. White comments:

In recent experiments which confirmed this theory, BTL scientists used a cadmium sulfide crystal which had quartz transducers attached at opposite ends.

One tried to convert a radio frequency input pulse into an equivalent sound wave in the crystal, while the other converted the received wave into an equivalent electrical output signal.

One tried to convert a radio frequency input pulse into an equivalent sound wave in the crystal, while the other converted the received wave into an equivalent electrical output signal.

The experiments showed that when a d.c. field is imposed on the cadmium sulfide crystal which is dark (un-illuminated), there is no effect on the signal passing through the crystal. If the crystal is illuminated but no electric field is applied, the piezoelectric stresses and the sound wave is attenuated.

When the crystal is illuminated and a sufficient voltage is applied to it, substantial signal amplification occurs.

To provide an unambiguous confirmation of the existence of the piezoelectric gain in the crystal, BTL scientists conducted a test in which no signal was applied but the crystal was illuminated and subjected to a d.c. electric field. In this, thermal noise within the crystal material had an acoustic resonance, producing ultrasonic waves. The amplification was more than sufficient to compensate for losses due to reflection at the piezoelectric transducers, causing the crystal to behave like a diode. This suggests that the new principle can be applied to oscillators as well as to amplifying devices.

They suggest that the new traveling wave acoustic amplifier may be able to operate at frequencies in the gigacycle (giga-cycle) region, but this

has not yet been proven by experiment, a BTL spokesman says.

Present plans call for a study of the basic characteristics of the new device which is expected to have a size-figures comparable to transit diodes. It is reported that coating of the crystal will lower its noise figure, within limits.

There is a variety of possible piezoelectric semiconductor materials which might be used. Generally there are the class 2-6 and 3-5 compounds. Cadmium sulfide and zinc oxide are representative of the first type, while gallium arsenide and indium antimonide are typical of the second class.



**New Role for Electric Typewriter?**—RADC Air Development Center scientists are considering a new role for the familiar electric typewriter as an early warning electronic typewriter for military communications systems. Major problems at present is that a hard copy message can be transmitted half way around the world in a few seconds, but over it arrives at the major military facility there is a fairly way to deliver it to the individual for whom it is intended. Since most military offices already have electric typewriters, RADC is considering them as hard-copy output/input devices. A buffer storage element would have to be added to temporarily hold messages until the machine was available, but this could be a modest cost and present device.

**Radar Manual Being Surveyed**—New York University, under RADC sponsorship, is conducting a survey with the cooperation of 25 companies that make or test radar and high-power microwave equipment. Objective is to gather information to establish hazard, particularly to human eyes, of working near radar equipment. Survey will include both employees exposed to radar and those in unexposed office or home life to ascertain if the former have a higher incidence of eye degeneration.

**Screen Report New Photofluorium**—Photoluminescence-Hamamatsu scientists report that the maximum energy of photoelectrons emitted from N-type on gallium arsenide is independent of the energy of incident light quanta over the interval of 4.66 to 1.46 electron-volts, a phenomenon which has not previously been observed.

**Scientists Develop Pneumatic Computer-Mimetic**—pneumatic computer, capable of performing simple arithmetic operations and solving integral and differential equations, has been developed in the Soviet Union. The computer

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## PRODUCTION BRIEFING

Japanese government has approved a request from Mitsui & Co. to manufacture Fuji Ball 2000 12 passenger helicopter under license from Bell Helicopter Co. Agreement calls for production of Fuji Ball 2000 of 100 units by the end of 1985 of which 40 helicopters would be delivered to the Japanese Self-Defense Agency and the remaining 60 units would be available to private industry and for export. Mass production is scheduled to begin toward the end of next year.

Bell Aerosystems Co. will measure control response and acceleration of its vacuum rocket belt (AW June 12, p. 35) under a contract from Aerospace Medical Laboratory, Air Force Systems Command. Data from these stability, performance and control studies will be applied to future on rocket belt designs.

Dow Corning Corp. of Midland, Mich. is producing and marketing a new family of heat, cold and oxidation resistant materials called Hiresilastics that are available in most sizes and compatible with most petroleum oils. Produced in fluid, compound and gaseous forms, the materials behave similarly to desirable solvents but also have good solvent, fuel and chemical resistance and improved lubricity.

Air Force has awarded a contract to Republic Aviation Corp. for research design toward designing structural design experiments for aerospace vehicles. The contract also calls for investigation of internal components such as piping, electrical harness and component supports. The study will involve the ground and the vehicle's test from the earth's atmosphere through space operation and atmospheric re-entry.

Martin Co.'s Baltimore Division has signed a \$110,000 contract with National Aeronautics and Space Administration to build approximately 50 heat exchanger units for Space Shuttle boosters.

Long-Tecno-Vought, Inc.'s Tempe headquarters Division has received a \$1.5 million contract for manufacturing and modification of Air Force Douglas C-333 transports. Major modifications called for in preparation of an aircraft to receive a new type propeller and subsequent installation of the propellers.

Haven Corp., Birmingham, Ala., has received a \$2,215,899 Air Force contract for production of multi-purpose plus assemblies for F-100 aircraft.

## BUSINESS FLYING



HARTZELL PUMPER PRO, fully available to aid in docking the T-143 bulk amphibious, one also is used while maneuvering the line plane on the ground. Based on the HARTZELL P-103 is designed by U. S. distributor, Low Aircraft, is priced at \$14,995, includes radio. Top floats are easily into Raven's fully enclosed wings, reducing drag to provide about 170 mph cruise speed.

## Riviera Amphibian to Be Marketed in U.S.

By Edwin J. Balaban

Dallas, Tex.—First four plane, Light Raven single engine amphibious, designed and built by Louis Mochelotti in Italy, will soon start an extensive demonstration tour in the U. S. to introduce potential customers and dealers to the new Dallas company's marketing program.

The airplane, the fifth prototype F-113, recently arrived at Lake Field from New York and made its public debut at the National Business Aircraft Assn. annual forum at Tulsa, Okla., Sept. 10-15. It was then scheduled to be shown at National Pilot Assn.'s annual meeting at Tulsa following the NBAA show. Then Low Aircraft Co. Executive Vice President Jerry Spier plans to take it to Ansett Oceania & Photo Airs conference, St. Petersburg, Fla., Oct. 13-15 prior to an swing to the Pacific southwest the latter part of October. There he will make it available for demonstration by a Low dealer in Seattle, who reportedly has several firm prospects. Spier will then fly the amphibian to Santa Monica, Calif., for showing to a prospective dealer.

Low Aircraft, which is sole distributor in this country for the airplane, feels that its best dealer prospects are among those parties which have specialized in multi-engine business aircraft and that

would add a new single engine plane to their line to bolster their marketing program.

Spier explained to Aviation Week that his company has laid out three guidelines for prospective dealers—they must have available adequate service facilities and maintain a stock of approximately \$3,500 in spares that are not available in the U. S. and they must provide an instruction qualified in airplane operations, because the company will assist in gas-aiding customers with complete checkout in the aircraft and an initial, including having the customer pilot make approximately 50 water takeoffs and landings.

Low shall still stock approximately 18% of the dollar value of aircraft needs based on the outcome of an demonstration program. The company, headed by David T. Low, has offices in the Exchange Bank Building, Dallas, and operates from Reno, Nev. Field.

## Certification Required

Spier reported that the Riviera amphibious has a full Federal Aviation Commission certificate. The Italian manufacturer is now testing for production, with some delays having been experienced in procurement of specialized machine tools, but the outlook is that the first two production models will be completed next January.

Build-up would probably be four air-

craft in March, a six per month rate in April and eight per month rate by the end of 1983.

Retail price of the basic Riviera amphibious will be \$14,950 minus taxes, which will be optional depending on customer's choice. Radio installation will be made either by the distributor, Low Aircraft, or Associated Radio, Lake Field, or by the dealer, to customer specifications. The basic price will include a full instrument flight rules (IFR) panel, with dual gauges and various power, dual controls, general service plug for battery cut switch to save drain on the battery, full-time static Hartzell propeller, a hydraulically operated water skis, four-engine panel, automatic, corrosion proofing throughout to U. S. Navy specifications and structural steel tubing.

Inspection of the demonstration line at Lake Field indicated that the Riviera is a ruggedly built airplane, probably designed on the basis of airframe equipped with U. S. practice. Spier noted that production airplanes will have a lighter-weight wing than the prototypes, providing a max gross of approximately 170 lb. Another 35-92 lb will be profit in offering the airplane for production.

The production Riviera will have a gross weight of 1,375 lb., the same as the demonstration prototype, and actual load will be 1,245 lb.—sufficient to handle four people with full gas comple-

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most, including civilian backlog of 63 jet. Production phase, with complete 18 jet, will have 18 complete units of 180 air units to meet. Spot rental. The full airframe will come at 100 percent, 100-150 high industrial air speed, which the company, built in a contract of 2 to be completed with its long-term contract. The company is a joint venture of Conquest Industries, Inc. (C-470-P) of 100 jet, which replaces the other 140 jet. Conquest.

All weather capabilities should be included in the future being designed to take up to 40 jet per unit and 100 jet, which is a condition of the contract.

The full is scheduled to take 12 jet landing.

With the high wing mounted behind the large windows and wide entrance doors on both sides, the future entrance, which is the side's rear and front panel, with the back of the front seats folding down to further facilitate exit.

The panel layout is designed for ease of maintenance, a simple panel type layout splitting the panel into two. Removing a panel opens up the entire top of the back deck for checking behind the panel. Instrument operation is facilitated by quick-opening fasteners that permit the board to be pulled out.

Propeller engine lever is located by means of the front seats, which are the rearward side of the panel. Pulling the lever and pushing the throttle in one, which is the rear and side in checking the throttle, but comes in handy when performing the engine on.

Space and he had used the lever for landing on the ground.

Water under is retained or extended using a frame mounted on the wheel. One modification, a line mounted on a wheel of the landing light from a variable position in the bow to the wings. The present water mounted on the wheel will be replaced by a new wheel of S type, which is a condition of the contract.

## Turbo-Flight to Sell Potez 840 in America

Ken Potez and Turbo-Flight, Inc. of Chicago have signed a sales agreement with Turbo-Flight because the exclusive North American rights agent for the Potez 840 turbine-powered, four engine light transport aircraft.

Turbo-Flight has ordered a dozen units under contract to be delivered in April, 1962, and has taken an option on all 74 Potez 840s scheduled to be produced in 1962 (AWM, 28, p. 11). The company also will be joint and sales representative for North

America and is negotiating with 11 fixed-base operators in the United States, Canada and Mexico.

The fixed-base operators will provide regional service facilities if approved as an attached Turbo-Flight will maintain a spare parts depot at Chicago. Sales of the P840 will be handled through independent sales associates who will work on a direct commission basis instead of a Turbo-Flight commission basis. Combined Motors will provide service and parts distribution for the aircraft's Turbomeca turbine engines.

Don Potez, Turbo-Flight president, said the firm was formed to bring a French variety of the P-840 into the U.S. market. Chief stockholder in the company is Daniel Potez, president of Morton Salt Co.

The Potez P840, a 1624 seat aircraft designed for both land and water use, has been a private French venture so far. Recently, Potez has been considering an offer by the French government to produce the P-840 in France.

Speculation in France now is that the French government will advance production and to keep the work in France. The French version would be reported considering the P-840 as a replacement for its DC-3 transport fleet. If the aircraft is selected, the version might order as early as 30 aircraft. Turbo-Flight says deliveries can be made 18 months after a firm order is placed.

## PRIVATE LINES

Pugon Douglas PB-56B turbo turbo aircraft will be produced by two British Builders Viper 10 engines at 3,000 hp, about six. First flight of a prototype PB-56B is expected in 1962. The Viper 10 powerplants will enable the PB-56B to cruise at 40,000 ft at 500 mph.

First Super-EQM Catalina has been delivered to Selo Explorations Co., Ltd., by Transair Aviation, Ltd., of Montreal. The Catalina conversion, being offered by Transair in several configurations including high-density passenger, cargo, and executive models, will cruise at 3,800 ft at 392 mph with 55% of power. Gross weight is 32,000 lb. A tanker version is under development for use in fighting forest fires.

Caeco has changed its international sales meeting from Oct. 15-17 to Oct. 23-24 because of restrictions which will be imposed on air travel Oct. 14 by operation Skyshield, a military exercise during which all civilian aircraft movements will be banned.

No major changes have been announced in the Piper Colt or Conquest 180 for 1962. Both aircraft feature new paint schemes which basically are a white base with wings and tail with a choice of four to six trim designs. Conquest 180 has a newly designed olive drab and a "mottled" green engine. Prices on the new 1962 models have not yet been announced by the firm.

Boeck Aircraft Corp. has been testing Stratosphere business turboprop developed by Culligan Industries, Inc., Coalinga, Ind. The instrument projects indicator needle figure speed, power, and torque, giving the appearance of earth's surface, opposing into distance. Gold lines are at specific degrees of separation to permit accurate bank to be established. Culligan says.

Canadian Department of Transport has taken delivery of a Sikorski S-62 helicopter. The aircraft will be used for supply and inspection work on Canadian west coast.

Modification of a Beech T-34B to 260 hp in place of standard 225 hp. Conquest engine has been developed by U.S. Forest Service by Pacific Aircraft Corp., Berkeley, Calif., to improve the plane's performance in the light of operations. T-34B is used by Forest Service as a lead plane to direct activities of aerial tasks, requiring close flying over rugged terrain. Conventional powerplant linked power and cooling necessary for normal operations under extremely poor flying conditions in extremely high temperatures.

Acquisition of General Aviation Supply Co. in Little Rock, by Van Dusen Aircraft Supplies, Westbrook, N.J., controls the latter company's operations to 14 major cities. Addition will be known as the company's General Aviation Division.

Poeth of Hawthorn House, has been added to Queen Elizabeth II's personal transport service of the British Royal Air Force. Three previous Hawthorn have flown more than one million miles with members of the royal family and distinguished guests.

Federal Aviation Agency has approved weight loads for the 1961 Piper Conquest 250. The aircraft is a single fixed-wing aircraft with a 130 ft of the aircraft is equipped with Piper's optional wing tanks. Turbo is manufactured by Batten Industries, Inc., Hawthorne, Calif., and weighs a total of 24 lb. per pair.



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## CAB Accident Investigation Reports:

## Approach Planning Cited in Electra Crash

At approximately 0900 EST, Sept. 14, 1960, a Lockheed Electra, Model L-103A, N 6617A, owned and operated by American Airlines, Inc., struck a lake and crashed during an approach to a landing at La Guardia Airport, New York, N.Y. Approximately half of the 76 persons on board at the time were injured or killed; one was killed. The aircraft was severely damaged by impact force and fire.

The flight scheduled as Flight 361 departed Boston at 0714 EST, with its destination set for La Guardia, N.Y., and with a planned intermediate stop at LaGuardia Airport. About 10 min. prior to departure a crew change was made when a check pilot boarded the aircraft to fly-check the flight report. This check pilot, by mutual agreement with the crew and in accordance with existing company policy, took over the left seat pilot's command seat with the primary check pilot acting as the first pilot.

The trip was neither a flight approach at LaGuardia.

It is the board's opinion that the pilot, in attempting to land in short or possible, did not properly plan the approach and as a consequence miscalculated the height of the aircraft above the ground when crossing the lake.

As a result of the investigation and hearing, two recommendations were sent to the Federal Aviation Agency.

1. On Sept. 22, 1960, it was recommended that the "Visual Glide Slope System," then undergoing tests by the FAA, be applied to LaGuardia Airport at some as possible.

2. On Dec. 15, 1960, it was recommended in a letter to the Administrator that the present procedures for providing illumination of passages over obstructions be reviewed.

Other factors of the investigation have been studied, one of which is the operation of an aircraft when engine failure occurs.

### Investigation

American Airlines Flight 361 of Sept. 14, 1960, a Lockheed Electra L-103A, N 6617A, was a scheduled passenger flight between Boston, Mass., and St. Louis, Mo., with an intermediate stop at LaGuardia Airport, New York, N.Y. The crew consisted of Captain Gordon E. Staples, First Officer Herbert E. Schuchman, Flight Engineer Kenneth F. Thorne, and Stewardess Margaret Fleming and Donna Calogian.

Prior to departure the crew was briefed on the available terminal and en route weather conditions as well as published forecasts. The last Boston weather at 0600 was clear, visibility 15 mi., light wind southwesterly 10 kt., altitude 2500.

Normally, a flight log was prepared by

the crew which specified a flight from Logan Airport, Boston, to LaGuardia Airport, in accordance with Visual Flight Rules (VFR), at a maximum altitude of 4,000 ft. and a speed 250 kt., and an estimated time en route of 45 min.

Approximately 10 min. prior to departure, Senior Captain Staples, who was the pilot, boarded the aircraft for the purpose of conducting a visual approach (check of flight engine, throttle, and other instruments) and a visual check of the runway. Captain Staples observed the left pilot's seat and Captain Staples moved to the jump seat located immediately behind the captain's station.

The flight reported at 0701. The crew took off at the time of departure was 91, 805 ft. and on the way down was 91, 150 ft. Fuel on board weighed 73,600 lb. and estimated fuel burn-off on the Boston LaGuardia leg of the flight was 5,600 lb. There were 76 passengers on board.

At 0702, Flight 361 left LaGuardia approach control and reported it was now New Rochelle VFR. The flight was then given the following clearance: "American 361, LaGuardia approach cleared, at New Rochelle, contact LaGuardia Tower 118.7, runway 31, wind west-southwest 18, altimeter 30.02, field information two eight closed, runway 31, 4,000 ft. long, here you're radio contact." Flight 361 continued along and at 0705 reported to LaGuardia Tower that it was overhead and gave the wind as southeast 20 kt. in the landing clearance. The words of the clearance were repeated by read and sent on the outside window panel.

The emergency lights in the cabin were not lighted. Some passengers were able to sit down, others were seated. All on board tried to get out of the aircraft. The stewardess, who were seated in the rear of the aircraft, did an excellent job in affording the fans of the passengers by quickly cutting out the necessary instructions for de-boarding. The lounge out door was de-boarding and partially open. The stewardess and a passenger noted this heavy door suddenly shut and it was used as an exit. They immediately closed the passenger door to meet to the side of the aircraft. A passenger attempted to open the buffet service door but was unsuccessful. Everyone questioned and then immediately began using the exit door as safely.

Two other mechanics who were not on board were working on a parked aircraft only a short distance away. They jumped on their feet and down in the aisle immediately. They were able to extricate a few by the buffet service door and open it. The passenger immediately began using the exit door as safely.

A male passenger (passenger) who was approximately 20 ft. above the runway, jumped an emergency window and fell into the water.

lost. The lake is shallow and its top surface is water level.

Investigation revealed that all four seats damaged on fire had struck the upper portion of the window bulkhead on the exterior side of the lake. In going over the top of the lake the left window crashed to a depth of 4 ft. in water. The right window was deflected from the result of the irregularity in the lake surface. Accurate measurements indicated that the aircraft was 8.2 ft. above the water and the crew was 1 ft. below the top of the lake at the time of impact contact.

### Crew Description

After initial impact, Nos. 1 and 2 passengers struck the ground 110 ft. further on. The aircraft rolled to the left and pitched down. In doing so it became inverted and reversed its direction. The left wing was torn off partially by the lower ground the landing gear which it struck the lake and then completely away on contact with the ground. The aircraft struck in the left wing immediately upon impact and in the right wing during the sideways movement to the center of the aircraft until all passengers had reversed. The aircraft was automatically damaged by impact force, shock, and fire. The aircraft came to rest approximately 1,000 ft. from the lake and 150 ft. to the left of the left edge of the runway and land.

When the aircraft stopped sliding, its occupants found themselves hanging upside down by their safety belts. To add to the confusion, the words of the clearance were repeated by read and sent on the outside window panel. The emergency lights in the cabin were not lighted. Some passengers were able to sit down, others were seated. All on board tried to get out of the aircraft. The stewardess, who were seated in the rear of the aircraft, did an excellent job in affording the fans of the passengers by quickly cutting out the necessary instructions for de-boarding. The lounge out door was de-boarding and partially open. The stewardess and a passenger noted this heavy door suddenly shut and it was used as an exit. They immediately closed the passenger door to meet to the side of the aircraft. A passenger attempted to open the buffet service door but was unsuccessful. Everyone questioned and then immediately began using the exit door as safely.

Two other mechanics who were not on board were working on a parked aircraft only a short distance away. They jumped on their feet and down in the aisle immediately. They were able to extricate a few by the buffet service door and open it. The passenger immediately began using the exit door as safely.

A male passenger (passenger) who was approximately 20 ft. above the runway, jumped an emergency window and fell into the water.

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through it. As he ran around the cabin he felt the aircraft in the direction of the hangar he thought of the crew. They were still trapped in the cockpit, hanging on to the wings. The crew located the critical emergency cable release for the cabin door on the captain's table, activated it, and pulled the cable through the window. The cabin door burst open. Before the cabin door was fully open, the flight crew, meanwhile, and the two men in the cabin through, checked the aircraft to be certain all passengers were out. All on board were saved from a situation which at first looked completely hopeless. All 73 jet straps and the two instruments were salvaged. The aircraft was apparently destroyed. Only three of the five available names of crew were saved.

Three aircraft were awaiting takeoff close west of the runway ramp of runway 11 when the accident occurred. The pilots of these aircraft and the approach appeared to be normal except that the aircraft was low when crossing the dike and appeared to settle. One of the pilots stated that he thought this aircraft was in low during the final portion of the approach that it might strike the dike and that he considered trying to warn the pilot by radio but decided against it.

**Geological Encounters**

The reason for offer witnesses was that the approach was normal in that it was neither a steep nor a long day on approach.

Captain Pughmore testified that he was attempting to land short and that for the type of landing the approach was completely normal and in the last few seconds a descent draft was encountered and the severe loss perceptible. The lift wing dropped and recovery action was immediately applied and there was insufficient time to correct this by applying power. The buffer and the

the most legal approach was unknown. After turning on final approach, power and air speed were gradually reduced to 200 kts per second and 128 kt. This approach was the last called by the first officer just before striking the ditch.

The \$185 opening manual runway-sensor respond over the airport boundary is 115 in for an Airbus aircraft weighing approximately 90,000 lb.

servit had been maintained in accordance with prescribed procedures and was in an aerobically condition prior to the accident. Measurements of the propeller blade angles disclosed that they were positioned at approximately 13 deg. Data supplied by the powerplant manufacturer revealed that at the black height the engine would be developing 300 hp at 1750 in. r.p.m.

The tree was *grossly* unbalanced.

My only regret was that had my suit belt not been fastened, it wouldn't have made any difference. I never let my bumps that would have jolted me off my seat. He for that started that just before reaching the old tin carpool and mankind's person dropped slightly, accompanied by a moaning feeling, and he reached power as concrete action.

### High-Pressure Area

On Sept. 1988, 1988, a high-pressure area was centered 350-400 mi southwest of New York City. This area of high pressure resulted in a flow of air at the surface from the southwest or southwesterly direction from the Virginia-North Carolina border southward. The flow of air was strong enough so that dry there was no frost affecting the New York City area and the days were not really clouded. Violations were rare, starting, ranging from 12 to 15 mi at most. The surface temperature at LaGuardia at the time of the accident was 17F, and the air temperature was approximately 10 F. The wind was from the southwest at 10 to 15 mph after the accident. The clouded straight low surface wind started from 17 to 13 F. A horizontal gust was not given in this type record. The wind measuring component is located on the roof of the

The control tower. The wind remaining on most (single runway) is located 55 ft above the ground, and the anemometer which is connected to the direct reading dial in both the control tower and the U.S. Weather Bureau office, is located 57 ft above the ground. The local weather observations, required upon certification of an accident and recorded at OH4, indicated that the day was clear, visibility 15 mi., and wind from north-west 16 kt., with gusts to 24 kt. There were no pilot reports concerning wind or turbulence information available for reference in John Starnes' probe to the accident.

2. The available length of the runway on the day of the accident was 4,099.2 ft. The decrease in length of 467.5 ft was necessary because of construction in progress on runway 4-22. The available portion was measured from the approach end of runway 15 and was marked by PAVA signs of runway center painted on the runway. Third old lights were present on both sides of the paved runway surface. The approach photo, dated Aug. 15, 1980 was in the pilot's right manual and it showed the decreased runway dimensions.

**Landing Distance**  
The company's operations manual shows that for an F-4 Phantom II weighing approximately 37,767 lb. and landing on runway 31 under the conditions which prevailed Sept. 14, 1980 the minimum effective runway length required is approximately 4,040 ft. The incident occurred the end of the base.

surface at a weight of 50 lb. steps as landing position. Two ropes, operating together, hoisted the landing basket to ground level power and hoisting in, across, at wheel berths. The shore winch, length of 8,000 ft, includes a safety factor of 40% of the datum. The actual shipping distance required was estimated to be about 2,700 ft.

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touring a glide slope plane of 40:1, still be identified and tracked as an obstruction. Further, that the trailing edge control of and light on top of the obstacle, the night identification and orange and white checkerboard painting for drivers, marking. The wind does not take specifically to what height the device marking was ordered. The file was the approach end of course 31 was marked accordingly, however, this area lacked marking the top in approach with this file.

### Analysis and Conclusions

Captain Pangloss and that he was at the airport to land short on the runway and would have been on it, had not been on the runway. The aircraft was at approximately 400 ft. from the runway, behind the obstacle, and that this device caused the aircraft to sink rapidly 60 to 80 ft. in a instant beneath the top surface of the slide, from which he could not escape. He further said that the aircraft was functioning in a normal manner when he received the signal.

It is believed that only light turbulence was encountered by Captain Pangloss during the final approach and that a part of the may have been caused by surface wind flow, was the slide, producing a bubble or eddy effect. Such an eddy effect, however, is not considered to have been significant in view of the height of the slide, wind direction type of aircraft involved, and the pilot's at the final approach with this type of eddy.

The Board also recognizes that a model based may have been involved in the construction work in progress at the end of course 31 and that this could have involved the aircraft in a short landing. Also the top of the slide may not clearly defined during daylight hours, and the night light provided a unique for the area if a pilot were approaching to cross the slide at dusk, as possible.

Notwithstanding these conditions, the Board believes that a pilot possessing the knowledge and skill required of an airline pilot should have considered all evidence and evidence offered by them in planning the approach, and thus have avoided striking the slide by crossing it at a safe altitude.

As a result of this investigation and hearing, two recommendations were sent to the Federal Aviation Agency.

1. On Sept. 25, 1961, it was recommended that the "Visual Glide Slope System," then undergoing tests by the FAA be applied to McGraw-Hill Airport as soon as practicable.

2. On Dec. 11, 1961 it was recommended in a letter to the Administrator that the present practice for providing illumination of personnel not markings be discontinued.

### Possible Cause

The Board determines that the probable cause of the accident was the failure of the pilot to properly plan and execute the approach to a landing. Factors which were here considered were the shortened runway and the unmarked upper portion of the slide.

By the Civil Aeronautics Board  
Major S. Perry Chennam,  
Robert T. Morris, Vice Chairman,  
Claus C. Cramer, Member,  
G. Joseph Martini, Member,  
William G. Galt, Member.

The Civil Aeronautics Board was notified of the accident immediately after it occurred. An investigation was immediately initiated in accordance with the provisions of section 701(c)(7) of the Federal Aviation Act of 1958. Deputies were ordered by the Board and taken to New York, N. Y., Oct. 18 and Nov. 1961 and in Washington, D. C., Nov. 21, 1961.

American Airlines, Inc. is a Delaware corporation with its principal office in New York, N. Y. The carrier holds a certificate of public convenience and necessity issued by the Civil Aeronautics Board, and is an owner operating certificate issued by the Federal Aviation Agency. These certificates authorize the carrier to engage in air transportation of passengers, cargo and mail between the United States, including the coast-to-coast.

### Crew Qualifications

Captain William L. Pangloss, age 47, was employed by American Airlines on Nov. 25, 1961. He held a recently effective active transport pilot (certificate) rating certificate with the following ratings: single and multi engine land, DC-3, DC-4, DC-6, DC-7, CV-340, CV-340, CV-440, and 3,114 hours of flight in a total flight time of 14,042 hours based on which 270 was a Lockheed L-1049 aircraft. He passed his last FAA first class medical examination Apr. 7, 1961.

Two medical certificates included a waiver specifying corrective lens for near vision.

Charles Gordon E. Smith, age 47, was employed by American Airlines on July 11, 1961. He held a recently effective active transport pilot (certificate) rating certificate with the following ratings: single and multi engine land, and DC-3, DC-4, DC-6, DC-7, CV-340, CV-340, CV-440, and 1,181 air hours.

He had a total flight time of 13,310 of which 450 were in Electra aircraft. He passed his last FAA first class medical examination May 11, 1961.

First Officer Herbert F. Scholten, age 38, was employed by American Airlines on June 13, 1961. He held a recently effective active transport pilot (certificate) rating certificate with the following ratings: single and multi engine land, and DC-3, DC-4, DC-6, DC-7, CV-340, CV-340, CV-440, and 3,114 hours of flight in a total flight time of 7,510 of which 180 were in Electra aircraft.

He last FAA medical examination was successfully taken May 25, 1961.

Flight Engineer Kenneth P. Thomas, age 36, was employed by the company. He held a recently effective active transport pilot (certificate) rating certificate with the following ratings: single and multi engine land, and DC-3, DC-4, DC-6, DC-7, CV-340, CV-340, CV-440, and 1,181 air hours of which 120 were in Electra aircraft.

He passed his last FAA medical examination Jan. 26, 1960.

Stenoedon Donna Gilligan, age 34, held a flight engineer rating certificate and was employed by the company. She held a flight engineer rating certificate with the following ratings: single and multi engine land, and DC-3, DC-4, DC-6, DC-7, CV-340, CV-340, CV-440, and 1,181 air hours of which 120 were in Electra aircraft.

The aircraft was a Lockheed Electra, Model 1-240, serial No. 1117. It was manufactured by the firm in 1960 and had 37,000 hours, respectively, at company service. The aircraft was a Lockheed Electra, Model 1-240, serial No. 1117. It was manufactured by the firm in 1960 and had 37,000 hours, respectively, at company service. The aircraft was a Lockheed Electra, Model 1-240, serial No. 1117. It was manufactured by the firm in 1960 and had 37,000 hours, respectively, at company service.

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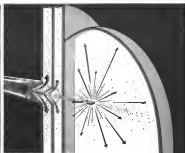
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